University of Alberta

Lifestyle Behaviours of Overweight Children

by

Julie Marie Lenk ©

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Canada

ABSTRACT

Background: Little information is available on the lifestyle behaviours of overweight children in Canada. **Objective(s):** To describe the anthropometric characteristics and lifestyle behaviours of 8 – 17 year old overweight children (and their parents/caregivers) referred to the Pediatric Centre for Weight and Health (PCWH) for weight management. **Methods:** Height, weight, BMI and waist circumference (WC) were measured with 45 children and 54 parents/caregivers; four-day food records and pedometer logs, as well as a seven-day Physical Activity Recall questionnaire, were completed. **Results:** In relation to Canadian lifestyle recommendations, children had unhealthy eating habits, low levels of physical activity, high amounts of screen time and shorter than recommended sleep durations. Children who met the screen time recommendation (<90 minutes/d) had smaller WC and BMI compared to children who did not. Maternal and child anthropometry and dietary intake variables were intimately linked. **Conclusions:** Weight management programs should emphasize improvements in lifestyle behaviours for overweight children and parents/caregivers to encourage healthy behaviour changes within families.

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LIST OF ABBREVIATIONS

AB:	Alberta
BMI:	Body Mass Index
CDC:	Centers for Disease Control and Prevention
CFGHE:	Canada's Food Guide to Healthy Eating
CPAGCY:	Canada's Physical Activity Guide for Children and Youth
CPAGHAL	Canada's Physical Activity Guide to Healthy Active Living
Food Pyramid:	American Food Guide Pyramid
IOTF:	International Obesity Task Force
Kcal:	Kilocalories
MET:	Metabolic Equivalent
MVPA:	Moderate-to-vigorous physical activity
NHANES:	National Health And Nutrition Examination Studies
PAR:	Physical Activity Recall
PCWH:	Pediatric Centre for Weight and Health
SPSS:	Statistical Package for the Social Sciences
WC:	Waist Circumference
WHO:	World Health Organization

LIFESTYLE BEHAVIOURS OF OVERWEIGHT CHILDREN

CHAPTER ONE
INTRODUCTION

1.1 RATIONALE

Levels of childhood overweight and obesity continue to increase in Canada. This trend is disconcerting because of the association between childhood obesity and increased risk of chronic disease and other serious health consequences. Although childhood obesity is a complex condition involving genetic, environmental, behavioural and social factors, the major contributors to the childhood obesity epidemic relate to modern changes in lifestyle behaviours. Increased consumption of high calorie foods, decreased physical activity, and increased sedentary activity have been identified as key etiological factors. However, at the present time, there is little available information on the actual lifestyle behaviours of overweight children in Canada, and in particular, Edmonton, Alberta.

1.2 PURPOSE

The purpose of this research project is to describe the population of 8 to 17 year old overweight children referred to the Pediatric Centre for Weight and Health (PCWH) located at the Stollery Children's Hospital (Edmonton, AB). Demographic and anthropometric characteristics as well as lifestyle behaviours of children and their parents/caregivers referred to the PCWH for weight management will be described. Baseline data from all children and parents/caregivers assessed at the PCWH will be examined to determine if current behaviours correspond to Canadian recommendations for food intake, physical activity, sedentary activity, and sleep duration. Understanding the lifestyle behaviours of overweight children enrolled in the PCWH will help to determine the type of weight management programs that are required to assist overweight boys and girls to adopt and maintain healthy behaviours to manage their weight.

1.3 RESEARCH QUESTIONS

The research questions for this study were as follows:

1. What are the demographic and anthropometric characteristics and lifestyle behaviours of overweight 8 to 17 year old children referred to the PCWH for weight management and their parents/caregivers?

2. What are the relationships among lifestyle behaviours of 8 to 17 year old children referred to the PCWH for weight management?

3. What are the relationships between lifestyle behaviours and anthropometry of 8 to 17 year old children referred to the PCWH for weight management and their parents/caregivers?

1.4 OBJECTIVES

The objectives of the present study were:

1. To describe the demographic and anthropometric characteristics of children and their parents/caregivers referred to the PCWH for weight management.

2. To determine if children referred to the PCWH achieve Health Canada's minimum Food Group recommendations according to Canada's Food Guide to Healthy Eating. Recommendations are as follows:
   - **a.** Minimum of 5 servings of Grain Products.
   - **b.** Minimum of 5 servings of Vegetables and Fruit.
   - **c.** Minimum of 2 to 3 (depending on age) servings of Milk Products.
   - **d.** Minimum of 2 servings of Meat and Alternatives.
   - **e.** Moderate consumption of Other Foods.

3. To determine if children referred to the PCWH achieve Canada's Physical Activity Guide for Children and Youth's minimum physical activity recommendations. Recommendation is as follows:
   - **a.** Minimum of at least 90 minutes of physical activity per day, including 60 minutes of moderate physical activity and 30 minutes of vigorous physical activity.

4. To determine if children referred to the PCWH achieve gender specific step recommendations. Recommendations are as follows:
   - **a.** ≥12,000 steps per day for girls.
   - **b.** ≥15,000 steps per day for boys.

Note: The 10,000 step per day recommendation for adults will be used to determine if parents/caregivers are meeting physical activity recommendations in our study.

5. To determine if children referred to the PCWH are below Canada's Physical Activity Guide for Children and Youth's maximum sedentary activity recommendation. Recommendation is as follows:
    a. Maximum of 90 minutes of non-active or sedentary time (television, computer games, video games) per day.

6. To determine if children referred to the PCWH achieve minimum sleep recommendations. Recommendations are as follows:
    a. Minimum of 10 hours of sleep for 6.0 to 11.9 year olds
    b. Minimum of 9 hours of sleep for 12.0 to 18.0 year olds

7. To examine the inter-relationships among children's food intake, physical activity levels, sedentary activity levels (screen time) and sleep habits.

8. To determine the relationships between children's lifestyle behaviours and anthropometry.

9. To examine relationships between child and parent/caregiver lifestyle behaviours and anthropometry.

CHAPTER TWO
LITERATURE REVIEW

This literature review will discuss prevalence, causes, risk factors and health consequences of childhood overweight/obesity and will review lifestyle behaviours of Canadian children. The lifestyle behaviours discussed will focus on food intake, physical activity, sedentary activity and sleep habits.

2.1 CHILDHOOD OVERWEIGHT IN CANADA

2.1.1 ***Description of Overweight and Obesity***

The terms overweight and obesity are often used interchangeably; however, overweight is not equivalent to obesity. Overweight is considered excess fat or other tissue related to an individual's height (Troiano & Flegal, 1999), whereas obesity is defined as an excess accumulation of body fat (adipose tissue) (Troiano & Flegal, 1999; Nieman, 1999) that may adversely affect health (WHO, 2000) or increase adiposity-related health risk.

2.1.2 ***Definition of Overweight and Obesity in Children***

There are different criteria for defining overweight and obesity in children. Many studies use body mass index (BMI) to define overweight and obesity. Two common references that use BMI to define children's weight status are the International Obesity Task Force (IOTF) cut-offs (Cole et al., 2000) and the Centers for Disease Control and Prevention (CDC) growth charts (Centers for Disease Control and Prevention, 2000). The IOTF cut-off classifications were developed by Cole and associates (2000) who calculated age and sex-specific BMI cut-off values from 2 to 18 years for 'overweight' and 'obesity'. The cut-offs were derived using average percentile curves and the adult BMI overweight (25 kg/m^2) and obesity (30 kg/m^2) cut-off points. Weight and height measurements from six international, nationally representative cross sectional growth studies (approximately n=100,000) in Brazil, Great Britain, Hong Kong, Netherlands, Singapore, and the United States (US) were used to develop this classification. The CDC growth charts, developed by the US Centers for Disease Control and Prevention, evaluate children's (age 2-20 years) weight status using categories of 'at risk of overweight' and 'overweight'. At risk of overweight is defined as a BMI-for-age and sex at or above the 85th percentile, but below the 95th percentile; overweight is defined as at or above the 95th percentile of BMI-for-age and sex (Kuczmarski et al., 2000). The CDC growth charts were developed based on weight and height data collected from US children participating in the National Health And Nutrition Examination Studies (NHANES) over the past 2-3 decades (Ogden et al., 2002; Kuczmarski et al., 2000).

Recently, the Dietitians of Canada, the Canadian Paediatric Society, the College of Family Physicians of Canada and the Community Health Nurses Association of Canada released a public policy statement (2004) recommending that the IOTF cut-offs be used for international or national group comparisons and the CDC growth charts be used for monitoring the growth of individual children. However, height and weight measurements of Canadian children were not included in either the IOTF cut-offs or the CDC growth chart references. Therefore, until nationally representative data on heights and weights of children are available, health professionals and researchers must depend on comparisons with references that may not represent the unique characteristics of Canadian children (Ball & Willows, 2005).

Note: For simplicity, the term 'overweight' will be used in this literature review when describing children who are overweight and/or obese. However, when referring to and/or discussing previous research, the terms (overweight/at risk of overweight/obese) used in the study will be applied.

2.1.3 *Prevalence of Childhood Overweight*

The prevalence of overweight among boys and girls has increased dramatically in Canada in recent years. According to the measured heights and weights in the Canadian Community Health Survey (CCHS) 2004 (Shields, 2005), 26% of Canadian children aged 2-17 years of age were overweight or obese and 8% were obese. These prevalence estimates are approximately 11% higher for the combined overweight and obesity rates and 5% higher for the obesity rate than they were in the Canada Health Survey 1978/79. Adolescents aged 12-17 years displayed the most dramatic increase in overweight and obesity rates in the last 25 years; overweight/obesity rate more than doubled (14.0% to 29.0%) while obesity rate tripled (3.0% to 9.0%). Although not as high, children aged 6 to 11 years also showed a significant increase in overweight/obesity rates from 1978/79 to 2004 (13.0% to 26.0%). Overweight/obesity rates of 2 to 5 year old children remained unchanged at 21.0%.

Prior to the CCHS, most prevalence estimates were based on self-reported height and weight data. From 1981-1996, the prevalence of overweight, in 7 to 13 year old children tripled among boys (11.0-33.0%) and doubled among girls (13.0-27.0%) while the prevalence of obesity increased from 2.0 to 10.0% in boys and from 2.0 to 9.0% in girls (Tremblay et al., 2002). Similarly, findings from a study by Janssen et al. (2004) on a nationally representative sample of 11-16 year old adolescents indicated that, in 2002, 15.0% of 11-16 year old Canadian youth were overweight while 5.0% were obese. It is important to note that prevalence estimates yield different results from various research studies depending on the reference population used. In Alberta, prevalence estimates increased from 10.0% in 1981 to 23.1% in 1996, the lowest childhood overweight prevalence of all Canadian provinces (Willms et al., 2003). Although these 1996 estimates fell below the national average of 29.3%, childhood overweight is still a concern for Alberta youth. Local surveys have estimated that approximately

25.0% of children in the urban Edmonton-area are overweight (Ball et al., 2001). In addition, research by Plotnikoff et al. (2004) that included rural high school students in Alberta showed that 17.6% and 9.3% of boys were overweight and obese, respectively, while 10.3% of girls were overweight and 4.8% were obese.

2.1.4 *Populations of Children at Risk for Overweight*

There are specific populations of children at increased risk for overweight. In Developed countries, there is an inverse relationship between obesity and socioeconomic status (SES) [World Health Organization (2000)]. Research by Willms et al. (2003) confirmed that a similar relationship exists for Canadian children. Their findings demonstrated that regardless of geographic region, SES was inversely related to prevalence of overweight in Canadian children (Willms et al., 2003). Willms and colleagues reported an increase in prevalence of childhood overweight in all areas of Canada suggesting an increase in overweight prevalence across all SES categories (low, average and high).

In 2004, the CCHS (Shields, 2005) revealed that income and education are linked to overweight and obesity risk in children. Findings from the survey found that children from middle-income households were significantly more likely to be overweight/obese or obese (29.0%) than were children from high-income households (23.0%). The survey also found that children were more likely to be overweight/obese if they lived in a household where members had a high school diploma or less (31.0%) compared to children living in a household where the highest level of education was postsecondary graduation (26.0%). These results are consistent with previous research by Molarius and colleagues (2000) who demonstrated that less education is associated with a higher BMI in adults.

Ethnicity also affects childhood overweight risk. High rates of obesity in various minority ethnic groups have been reported (Shields, 2005; Strauss & Pollack, 2001; Hanley et al., 2000). Research in the US has shown that, over the last 30 years, 6 to 11 year old black children (4.0% to 20.0%) experienced much larger secular increases in overweight than white children (4.0% to 13.0%). The same research revealed that among older children, 12 to 17 years of age, the prevalence of overweight increased by 15.0% in Mexican-American children, 14.0% in black children and only 7.0% in white children (Freedman et al., 2006). In Canada, high childhood obesity levels have been reported among First Nations children in areas of northern Ontario (Hanley et al., 2000) and Quebec (Willows et al., 2006; Potvin et al., 1999; Bernard et al., 1995). Studies have found that across North America, regardless of tribal or cultural group, the levels of obesity are greater in Aboriginal children than in Caucasian children (Dean, 1998). The reason for the varying obesity rates among ethnic groups is not completely understood; however, it has been suggested that different factors (genetic, environmental and behavioural) are operating to promote overweight and obesity among ethnicities (Freedman et al., 2006).

Rural *versus* urban living may also be related to overweight risk in children. Research comparing the prevalence of overweight/obesity among high school children in urban and rural areas of Ontario and Alberta, respectively, revealed that rural school children may be at increased risk for overweight/obesity in comparison to urban school children (Plotnikoff et al., 2004). Reasons for the rural/urban differences could be due to SES and parent education levels. Students from rural schools are more likely to come from low SES families whose parents have lower education levels and lower paying jobs (Statistics Canada, 2004). Lower income levels may be linked to less healthy food choices (Plotnikoff et al., 2004) and decreased ability to afford organized physical activity, which may lead to an increase in body fatness. Furthermore, rural communities may have limited access to recreational facilities affecting physical activity levels of children and families (Plotnikoff et al., 2004).

2.2 HEALTH CONSEQUENCES OF CHILDHOOD OVERWEIGHT

2.2.1 *Physiological Risk Factors for Chronic Disease*

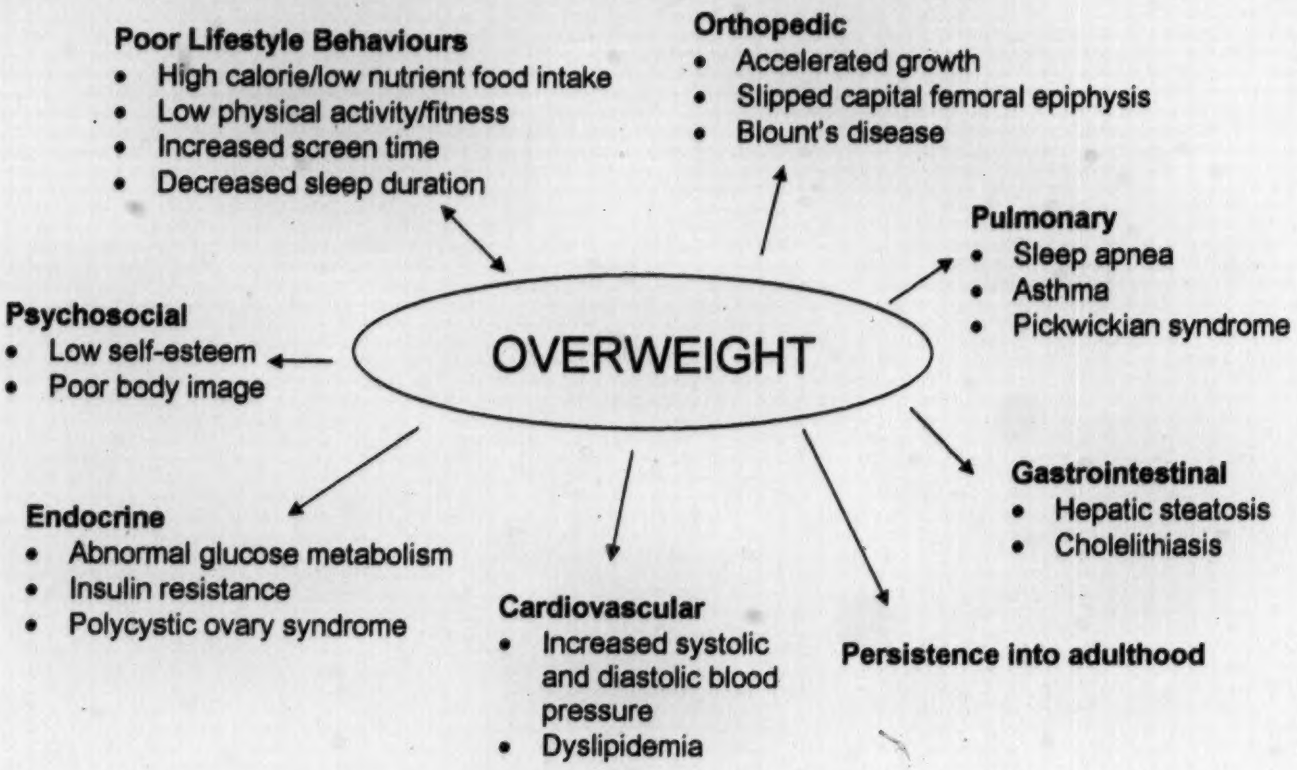
There is a plethora of research that explains and describes the wide range of physiological risk factors and health consequences associated with childhood overweight. Most alarming is the research showing that children with increased body fat are presenting with risk factors for adult diseases such as cardiovascular disease and type 2 diabetes (Ball & McCargar, 2003).

The Bogalusa Heart Study revealed that a BMI ≥ 85th percentile was associated with at least one risk factor for cardiovascular disease (dyslipidemia, elevated insulin levels, or hypertension) in 58.0% of the 813 overweight 5 to 17 year old children included in the study (Freedman et al., 1999). Similarly, Morrison and associates (1999) found that overweight children are more likely to possess higher low-density lipoprotein-cholesterol, higher triglycerides, and lower high-density lipoprotein-cholesterol. It has also been noted that in children, cardiovascular risk factors tend to cluster (Nicklas et al., 2002; Morrison et al., 1999). This clustering of risk factors (obesity, dyslipidemia, glucose intolerance, and hypertension) is referred to as the Metabolic Syndrome (Huang, et al., In Press). A study by Csabi and colleagues (2000) discovered that 8.9% of obese children (n=180) presented with four risk factors, while 79.1% of non-obese control children (n=239) were free from any risk factors. Research by Weiss and associates (2004) has also revealed that the prevalence of the metabolic syndrome increases with the severity of obesity. Although lifestyle and genetic factors contribute to the incidence of risk factors for cardiovascular disease among children, obesity is a major concern due to its link to disease risk and the fact that it may be preventable (Brown et al., 2002).

In addition to the cardiovascular health consequences of overweight, recent studies have also suggested that type 2 diabetes, previously thought of as an adult phenomena, has become more common among overweight children in various sub-groups throughout the world (Fagot-Campagna et al., 2000; Libman & Arslanian, 1999; Rosenbloom et al., 1999; Dean, 1998). Estimates have suggested that over the past two decades, there has been a 20-fold increase in the incidence of type 2 diabetes among children and adolescents (Cruz et al., 2005; Fagot-Campagna et al. 2001b). However, these estimates may not reflect the true prevalence within the population because many studies are based on clinical samples of children receiving medical treatment (Ball & McCargar, 2003). Nevertheless, youth who are diagnosed with type 2 diabetes are typically obese, have reached puberty and have a positive family history of type 2 diabetes (American Dietetic Association, 2000). Furthermore, children within minority populations such as African Americans, Latinos and Native Americans appear to be at increased risk of type 2 diabetes (Gahagan et al., 2003; American Dietetic Association, 2000; Fagot-Campagna et al., 2000; Dabelea et al.,1999).

Other health consequences related to overweight have also been noted in the literature (Chaput et al., 2006; Brown et al., 2002; Wabitsch, 2000; Morrison et al., 1999; Morrison et al., 1999a; Must & Strauss, 1999; Dietz, 1998) and are presented in Figure 2-1.

Figure 2-1. **Health consequences/risk factors related to childhood overweight**


Poor Lifestyle Behaviours
High calorie/low nutrient food intake
Low physical activity/fitness
Increased screen time
Decreased sleep duration
Orthopedic
Accelerated growth
Slipped capital femoral epiphysis
Blount's disease
Pulmonary
Sleep apnea
Asthma
Pickwickian syndrome
Psychosocial
Low self-esteem
Poor body image
OVERWEIGHT
Gastrointestinal
Hepatic steatosis
Cholelithiasis
Endocrine
Abnormal glucose metabolism
Insulin resistance
Polycystic ovary syndrome
Cardiovascular
Increased systolic and diastolic blood pressure
Dyslipidemia
Persistence into adulthood

2.2.2 ***Psychosocial Consequences***

Obesity has an immediate impact on a child's physical appearance (Doak, 2006) which can have a significant impact on childhood emotional development. Studies conducted as far back as the 1970's (Kirkpatrick et al., 1978; Caskey et al., 1971) revealed that children as young as 6 years old often described overweight people as lazy, lying, cheating, ugly, dirty and stupid (Strauss, 2002). Such attitudes are not new as older research (Richardson et al., 1961) found that children ranked obese children as the least desired friends. Although these findings are disturbing, similar beliefs are still evident in today's society which is contributing to the widespread psychosocial consequences of childhood obesity.

Numerous studies have shown that overweight and obese children suffer from low self esteem, lack of self-confidence and social isolation (Wabitsch, 2000; Must & Strauss, 1999), discrimination (Dietz, 1998), stigmatization (Latner & Stunkard, 2003; DeJong et al., 1980), and depression (Erickson et al., 2000). Greater emotional distress and lower expectations of educational future have also been reported (Mellin et al., 2002). A study by Davison and Birch (2001) found that girls as young as 5 years of age present with negative associations between weight status and self-concept. Thus, it is evident that childhood overweight and obesity have severe detrimental effects not only on the physiological health of children, but also their psychosocial health.

2.2.3 ***Persistence into Adulthood***

According to long term follow-up studies, obese children tend to become obese adults (Freedman et al., 2005; Freedman et al., 2004; Guo et al.,1999; Whitaker et al., 1997) with approximately 30.0% of adult obesity beginning in childhood (Styne, 2001).

This tracking of childhood obesity into adulthood further increases the long term health consequences of childhood obesity. Increased risk of type 2 diabetes, cardiovascular disease, insulin resistance, hyperlipidemia, osteoarthritis, cholelithiasis, certain types of cancer, and additional health consequences (Must et al., 1999) are partially related to the prolonged tracking of childhood obesity into adulthood (Doak et al., 2006). Furthermore, research by Must et al. (1999) found that adults have an increased risk of morbidity and mortality, independent of their adult weight, if they were obese in childhood.

2.2.4 *Cost of Childhood Overweight*

Health care costs related to overweight are substantial. In 1997, the total direct cost of obesity in Canada was estimated to be over $1.8 billion, which was 2.4% of the total cost of illness (Birmingham et al., 1999). The three largest comorbidities contributing to the total cost were hypertension, type 2 diabetes and coronary artery disease (Birmingham et al., 1999). In 2000/2001, it was estimated that obesity cost Canada's healthcare system $4.3 billion (Dietitians of Canada News Release, 2005). Similar trends were also seen in the US. Obesity associated annual hospital costs, for a national sample of 6-17 year old US children, increased from $35 million during 1979-1981 to $127 million during 1997-1999, representing an increase from 0.4% to 1.7% of total obesity associated hospital costs (Wang & Dietz, 2002). It is expected that these numbers will continue to rise as the childhood obesity epidemic increases.

2.3 CAUSES OF CHILDHOOD OVERWEIGHT

Childhood overweight has a complex etiology involving numerous genetic, social, behavioural and environmental factors. Genetic factors such as parental obesity increase the overweight risk for children (Whitaker et al., 1997); however, it is unlikely that the rapid changes in the prevalence of childhood overweight and obesity are solely due to genetic changes in the population (Townsend, 2006; Rosenbaum & Leibel, 1998). It is likely that the behavioural and environmental changes that have occurred in our society over the past several decades have led to the increasing trend of childhood body fatness.

2.3.1 *Energy Balance*

From a behavioural standpoint, the increased prevalence of overweight in a population can only occur when there is a sustained positive energy balance (Troiano et al., 2000). Positive energy balance results when energy intake exceeds energy expenditure. The shift to a positive energy balance or the 'nutrition transition' is suggested to be due to increased consumption of low fibre, energy dense foods, sweetened beverages and sugar combined with a decrease in physical activity and an increased sedentary lifestyle (Doak et al., 2006; Popkin, 2002).

2.3.2 *Family Environment*

Environmental factors that affect early dietary intake patterns of children can influence the development of overweight (Hood et al., 2000). Family environment has been shown in several studies to have a strong influence on children's eating behaviours (Golan et al., 1998; Fisher & Birch, 1995) and body fatness (Davison & Birch, 2002; Hood et al., 2000). Parenting styles (authoritative or permissive), parental control of child's diet, and parental attitudes toward their own dietary intake can also shape children's eating habits (Hood et al., 2000; Baughcum et al., 1998; Birch & Fisher, 1998; Johnson et al., 1994). These findings provide evidence that parents act as very powerful role models to their children, which therefore increases the complexity of the childhood obesity epidemic.

2.3.3 *Cultural Physical Activity and Dietary Patterns*

Modern lifestyles provide children with a variety of attractive opportunities to be sedentary and few demands to be physically active (Hill & Trowbridge, 1998). Activities such as playing video or computer games, watching television, and text messaging are examples of popular sedentary options for young people today. Changes in some cultural aspects of the environment such as parent work habits, safety concerns, drive up/through windows and decreased physical education classes in schools have reduced opportunities for physical activity among children (Troiano et al.,1995; Gutin et al., 1993). This decrease in physical activity and increase in sedentary activity promotes a sustained positive energy balance that has been blamed for the increase in body fatness of children.

Unhealthy, energy dense foods are abundant and readily accessible in the current environment (Wang et al., 2005; Troiano et al., 1995). Thus, it is no surprise that over the last few decades, the consumption of fast foods, pre-prepared meals, soft drinks, and candy have increased (French et al., 2001). Eating out has also become much more common in today's society. Research indicates that away from home eating is associated with higher energy, total fat and saturated fat intakes than eating at home (Guthrie, 2002; French et al., 2001). Based on data from nationwide American food consumption surveys (Nielson et al., 2002), total energy intake from foods consumed at home has decreased from 74.1% in 1977-1978 to 60.5% in 1994-1996 in 12-18 year old children. Consequently, the proportion of food consumed at fast food outlets and restaurants increased from 6.5% in 1977-1978 to 19.3% in 1994-1996.

Behavioural changes in snacking habits and increased intake of soft drinks have been noted among children over the last 20 years. Children are consuming snacks more frequently throughout the day, therefore increasing the contribution of daily snack calories to total energy intake (Jahns et al., 2001).

Between 1977-1979 and 1994, adolescents' daily consumption of soft drinks increased by 65.0% in girls and 74.0% in boys and accompanied a 15% decrease in milk consumption (Harnack et al., 1999; Borrud et al., 1997). This is not surprising as portion sizes of restaurant foods and fast foods have increased dramatically over the last few decades (Young & Nestle, 2002). The typical single-serving soft drink size has increased 250% from the 1950's to 2000, from 6.5-oz to 20-oz, respectively (French, 2003). Such changes in food and beverage consumption have been partially responsible for the increased body weights of children by contributing to excess energy intakes (St-Onge et al., 2003).

2.3.4 Sleep Habits

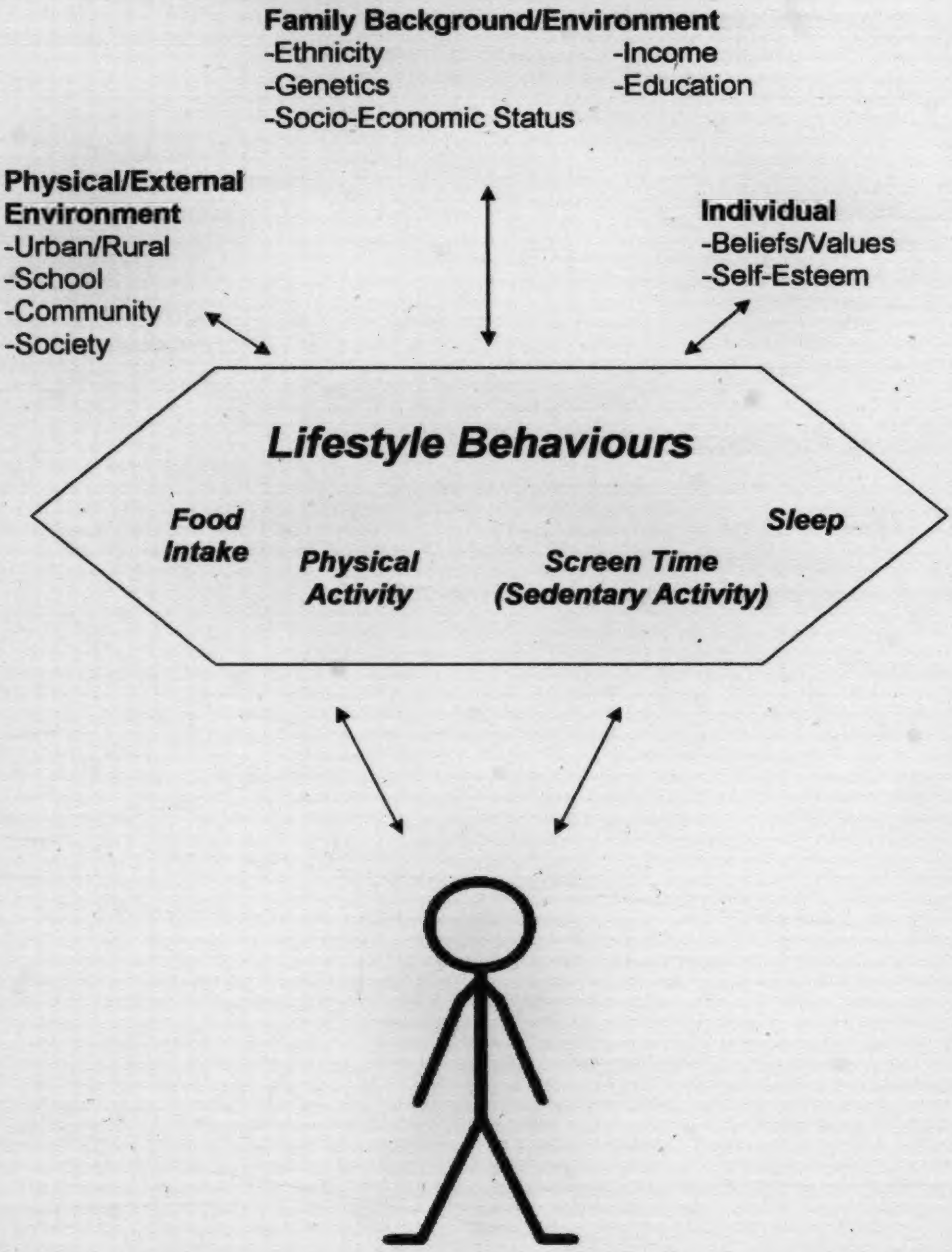
Sleep habits have also been shown to be linked to childhood overweight. Research has found that short sleeping hours are related to overweight and obesity in children (Chaput et al., 2006; Gupta et al., 2002). Studies on adults have provided some explanation for this association, revealing that sleep duration has an effect on the body's appetite regulator hormones, leptin and ghrelin (Spiegel et al., 2004; Taheri et al., 2004). As sleep hours decrease levels of ghrelin increase and levels of leptin decrease, causing an increase in hunger and appetite. However more research will need to be conducted in children to determine the relationship between sleep duration, appetite regulator hormones and body weight.

2.3.5 *Obesogenic Environment*

The environment can have a powerful effect on an individual's behaviour. Making healthy choices in an environment that promotes sedentary behaviours and a high energy intake can create a challenge for children and their families. It has been proposed that Canadians are living in an 'obesogenic environment'. The term 'obesogenic environment' has been defined by Swinburn & Egger as "the sum of influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals or populations" (Swinburn & Egger, 1999). An obesogenic environment encompasses more than just the physical environment; it also includes policies, laws, costs, values and social and cultural attitudes (Swinburn & Egger, 2002). In order to dissolve the obesogenic environment and create an environment that supports health, the physical environment, individual behaviours, and the determinants of health, need to be addressed.

As described, there are many factors associated with childhood overweight. Figure 2-2 illustrates the numerous factors involved in childhood overweight and how these variables shape lifestyle behaviours.

Figure 2-2. Factors that shape lifestyle behaviours and the role of lifestyle behaviours in childhood overweight


Family Background/Environment
-Ethnicity
-Genetics
-Socio-Economic Status
-Income
-Education
Physical/External Environment
-Urban/Rural
-School
-Community
-Society
Individual
-Beliefs/Values
-Self-Esteem
Lifestyle Behaviours
Food Intake
Physical Activity
Screen Time (Sedentary Activity)
Sleep

2.4 HEALTH BEHAVIOURS OF CANADIAN CHILDREN

Changes in lifestyle behaviours are thought to contribute to the increase in body weight of Canadian children. Therefore, the following four lifestyle behaviours of Canadian children will be discussed: food intake, physical activity, sedentary activity and sleep habits. In addition, current recommendations related to these lifestyle behaviours will be reviewed. Data on the lifestyle behaviours of Canadian children will be examined to determine if children are meeting healthy lifestyle recommendations.

2.4.1 Canadian Recommendations for Children

2.4.1.1 Food Intake Recommendations

Canada's Food Guide to Healthy Eating

Food intake recommendations have existed for Canadian's since 1942 when Health Canada published the first food guide (Health Canada, 2002). The version of the food guide that is currently being used is Canada's Food Guide to Healthy Eating (CFGHE) (Health Canada, 1992).

CFGHE separates foods into four food groups: Grain Products, Vegetables and Fruit, Milk Products and Meat and Alternatives. An "Other Foods" category refers to added fat, oils or sugar, beverages (soft drinks, tea, coffee, sport drinks, etc.), herbs, spices, condiments and high-fat and/or high-salt snack foods (Garriguet, 2006). Within each food group, a daily recommended range of servings and serving sizes are provided. CFGHE recommends 5-12 servings of Grain Products per day, 5-10 servings of Vegetables and Fruit and 2-3 servings of Meat and Alternatives per day. Milk Products recommendations vary with age. For children aged 4 to 9 years, 2-3 daily servings are recommended; 3-4 servings for 10 to 16 year olds and 2-4 servings for those aged 17 or older are recommended. CFGHE recommends moderate consumption of the "Other Foods" category.

2.4.1.2 Physical Activity Recommendations

Canada's Physical Activity Guide for Children and Youth

Health Canada's Physical Activity Guide for Children and Youth (CPAGCY) recommends that children increase the amount of time they are currently active by at least 30 minutes more per day, to achieve ≥90 minutes of physical activity per day. This increase in physical activity should include a combination of moderate (skating, bike riding, brisk walking, etc.) and vigorous (running, playing soccer, etc.) activities starting with 20 minutes of moderate and 10 minutes of vigorous up to ≥60 minutes of moderate and ≥30 minutes of vigorous activity (Health Canada, 2002).

Step Recommendations

Research indicates that the popular and readily accepted 10,000 steps per day recommendation for adults is likely too low to elicit substantial health benefits in children (Tudor-Locke et al., 2004). In response to this gap in the literature, Tudor-Locke and colleagues developed a step recommendation of ≥12,000 steps per day for girls and ≥15,000 steps per day for boys (~120-150 minutes of activity/day). These pedometer-derived cut points are best able to discriminate between children who are normal weight or overweight. Tudor-Locke et al. (2004) found that girls taking < 12,000 steps per day and boys taking < 15,000 steps per day were more likely to be overweight.

2.4.1.3 Sedentary Activity Recommendations

Canada's Physical Activity Guide for Children and Youth

Health Canada recommends that children decrease 'non-active' or sedentary time (TV, computer games, surfing the Internet, videos) starting with 30 minutes less per day to a total sedentary time goal of ≤90 minutes per day (Health Canada, 2002).

2.4.1.4 Sleep Recommendations

Canadian Sleep Recommendations

Currently, there are no Canadian sleep recommendations for children. Sleep averages and guidelines are provided (Capital Health, 2005); however, specific sleep recommendations are not available. For the purpose of this thesis, American sleep recommendations will be used.

American Sleep Recommendations

Based on epidemiological studies, Owens and Witmans (2004) recommend that most children between the ages of 6 and 11.9 years need between 10 to 11 hours of sleep. Adolescent (12 to 18 years) sleep needs are not dramatically different, with optimal sleep amounts at about 9 to 9.25 hours per night (Owens & Witmans, 2004; National Institutes of Health, 2003; Carskadon et al., 1980).

2.4.2 *Are Canadian Children Meeting Lifestyle Behaviour Recommendations?*

2.4.2.1 *Data on Food Intake of Children*

Historically, there were limited data on the eating behaviours of Canadian children (Alberta Coalition for Health School Communities, 2006). However, initial results of the 2004 CCHS: Nutrition (Garriguet, 2006) have been released. The 2004 Canadian Community Health Survey (CCHS): Nutrition is the largest and most comprehensive nutrition and lifestyle survey conducted in Canada, and is the first national survey performed since the 1970s to determine the eating habits of Canadians. Face-to-face, 24-hour food recall interviews were conducted with over 35,000 Canadians. The results of the survey include valuable information on the eating behaviours of Canadian children, adolescents and adults. For the purpose of this literature review, only the child and adolescent behaviours will be discussed.

Results of the survey revealed that in 2004, 27.0% of children aged 4 to 8 years of age did not meet the minimum Grain Products recommendation of 5-12 servings per day. Females were more likely than males to consume less than the minimum recommended servings of Grain Products per day, regardless of age. Findings also revealed that children and adolescents (2 to 17 years of age) consumed an average of 4.5 servings of Vegetables and Fruit per day, which is 0.5 servings less than the minimum five serving per day recommendation based on CFGHE. Seventy percent of children 4 to 8 years of age did not meet the minimum recommendation of Vegetables and Fruit. Similarly, children 9 to 13 years of age did not meet the minimum Vegetables and Fruit recommendation, with 62.0% and 68.0% of girls and boys, respectively, not meeting the recommendation. As for Milk Products, 37.0% of children 4 to 9 years of age were below the daily recommendation of two servings per day. And in children 10 to 16 years of age, 83.0% of girls and 61.0% of boys did not meet their minimum recommendation of three servings of Milk Products per day. On a more positive note, the survey revealed that all Canadians, regardless of age, were meeting the minimum 2-3 serving per day recommendation of Meat and Alternatives (Garriguet, 2004).

The CCHS also evaluated the intake of "Other Foods" to determine if Canadian's were following the CFGHE recommendation that "Other Foods" should be consumed in moderation. According to the survey, "Other Foods" accounted for 22.0% of the total calories consumed by Canadians. This total increased to 25.0% for adolescents aged 14 to 18 years of age. In addition, two-thirds of the calories derived from this category came from the top ten most commonly consumed "Other Foods" which were soft drinks (11.3% of calories), followed by salad dressing, sugars/syrups/preserves, beer, fruit drinks, oil/fats/shorting, margarine, chocolate bars, potato chips and butter (Garriguet, 2004). The results of this nation wide survey are revealing as they indicate that many Canadian children and adolescents are not meeting the minimum food group recommendations to support health, growth and development.

Similar results were found by Jacobs-Starkey (2001) and colleagues who also conducted a national study on the food habits of Canadians. Their study included 1,543 randomly selected adults and 178 adolescents (13-17 years). The food intake results of adolescents revealed that many 13-17 year old boys and girls were not consuming the minimum number of recommended servings from the four food groups according to CFGHE. Based on the study, 28.6% of boys and 44.1% of girls did not meet the minimum number of servings for the Grain Products. Similarly, minimum recommendations for Vegetables and Fruit were not met by 57.2% of boys and 44.1% of girls. The percentage of boys and girls that did not meet the minimum recommendation for Milk Products were 53.6% and 59.1%, respectively. Quite different from the results of the CCHS, 38.1% of boys and 57.0% of girls from Jacobs-Starkey's (2001) sample did not meet the minimum recommendations for Meat and Alternatives. It was also reported that children 13 to 17 years of age received 33.0% of their total energy from "Other Foods" (Jacobs-Starkey et al., 2001). Of further interest, an additional nationally representative sample of 11-16 year old Canadian youth (n=5890) found that less than half ~~of~~ children sampled reported eating vegetables or fruits more than once per day and approximately 25.0% reported eating sweets (candy, chocolate) and non-diet soft drinks more than once per day (Janssen et al., 2004).

Other research studies conducted in Canada also revealed that children and adolescents have poor eating habits. Pilot research conducted in British Columbia investigated the vegetable and fruit intake of children in grades 5 and 6. The study found that only 25.0% of children met the recommended minimum servings of Vegetables and Fruit per day according to CFGHE. The average intake of Vegetables and Fruit for grade 5 and 6 children was only 3.5 servings per day (Action Schools! BC, 2005).

In Nova Scotia, Veugelers and colleagues (2005) reported that high numbers of grade 5 children were not achieving minimum food group recommendations based on CFGHE. Results illustrated that 54.4% and 49.9% of children (n=4298) did not meet the recommended minimum number of servings for the Grain Products and the Vegetables and Fruit food groups, respectively. Moreover, 42.3% consumed inadequate intakes for Milk Products and 73.7% did not meet the minimum recommendations for Meat and Alternatives (Veugelers et al., 2005a). Findings from the same study (Veugelers et al., 2005b) found that children who ate supper (evening meal) with their families 3 or more times per week were at decreased risk of overweight, while children who bought their lunch at school were at increased risk.

As indicated, many Canadian children possess poor eating habits. This is of concern since vegetable and fruit consumption is linked to overweight or obesity in children. The 2004 CCHS data revealed that only 41% of Canadian children (2 to 17 years of age) reported eating vegetables and fruits 5 or more times per day (Shields, 2005; Stats Canada, 2004). Those children who consumed vegetables and fruits 5 or more times a day were substantially less likely to be overweight or obese than those who consumed vegetables and fruits less than 5 times a day. It is important to note that this survey did not measure actual serving sizes, but rather asked children the number of times they ate vegetables and fruits every day. Despite this, consuming more vegetables and fruits seemed to decrease the risk of childhood overweight or obesity.

2.4.2.2 *Data on Food Intake of Alberta Children*

Research conducted at the University of Alberta offers specific information on the eating behaviours of Alberta children. A web-based nutrition and physical activity survey, including an on-line 24-hour food recall, administered to grade 7 and 8 students throughout Alberta revealed that approximately 50% of boys were below all four food group recommendations according to CFGHE. Girls' diets were also poor with fewer than 50% meeting the minimum serving recommendations for three of the four food groups. Fifty percent of the girls exceeded the recommendations for the Vegetables and Fruit food group. The survey also revealed that 50% of grade 7 and 8 boys and girls consumed approximately one or more servings from "Other Foods" (Taft & McCargar, 2004).

Research by Ball et al. (2005) evaluated the dietary intake of a sample of normal weight (n=115) and at risk of overweight (n=20), 6 to 10 year old children in the Edmonton-area. Their findings illustrated that all children regardless of weight, consumed inadequate servings of Vegetables and Fruit and Meat and Alternatives, adequate servings of Grain Products and Milk Products and a high number of servings of "Other Foods" based on CFGHE. As indicated, dietary data on Alberta children vary depending on the sample population, however; similar to national reports, Alberta children possess poor eating habits.

2.4.2.3 *Data on Physical Activity of Children*

According to the Report Card on Physical Activity for Children and Youth, "less than half of [Canadian children] are expending the energy required to maintain a healthy weight, and to develop healthy hearts, lungs, muscles and bones" (Healthy Active Kids Canada, 2005).

Low physical activity levels of Canadian children are a major health concern. As children get older and the world becomes increasingly more modern, levels of physical activity continue to decrease (Federal, Provincial and Territorial Advisory Committee on Population Health, 1999). Janssen et al. (2004) found a high prevalence of physical inactivity among Canadian youth aged 11-16 years. Less than 20% of youth surveyed reported engaging in 60 or more minutes of physical activity on 6-7 days per week. Thus, 80% of children reported not meeting Health Canada's minimum recommendations for physical activity (Health Canada, 2002).

Physical activity behaviours of a nationally representative sample of Canadian children 2-17 years were also measured in the 2004 CCHS. Results of the survey found that only 42% of 6-11 year olds participated in 14 or more hours of physical activity per week, 43% participated in 7 to 14 hours, and 16% participated in less than 7 hours per week. Results revealed that more girls (41%) were sedentary than boys (26%). For girls, 59% were active/moderately active while 74% of boys met this criterion. Furthermore, physical activity levels were inversely associated with overweight and obesity for boys aged 12-17 years. There was no association between physical activity levels and overweight and obesity for 12-17 year old girls or for children at ages 6-11. Analyses also revealed that sedentary boys were more likely to be obese than active boys (16% versus 9%, respectively) (Shields, 2005).

Similar trends were seen in previous research that examined physical activity levels of Canadian children. In the 1996-97 National Population Health Survey (Federal, Provincial and Territorial Advisory Committee on Population Health, 1999), 1,047 children aged 12 to 14 and 1,243 children aged 15 to 17 were surveyed to determine their physical activity level during leisure-time in the three months preceding the survey. It was estimated that 44% of 12 to 14 year olds were active, 27% were moderately active and 30% were inactive. Similarly, 43% of 15 to 17 year olds were active, 21% were moderately active and 36% were inactive. At that time, children 12 to 17 years of age had the highest rates of leisure-time physical activity compared to any of the other age groups. However, despite having the highest level of physical activity, still less then 50.0% of 12 to 17 year olds were considered to be active.

It is unknown if Canadian children are meeting other physical activity recommendations. Tudor-Locke and colleagues (2004) developed a step recommendation of ≥12,000 steps per day for girls and ≥15,000 steps per day for boys (~120-150 minutes of activity/day) based on research that shows these pedometer-derived cut points are best able to discriminate between children who are normal weight or overweight. They found that girls taking <12,000 steps per day and boys taking <15,000 steps per day were more likely to be overweight. Because these thresholds were statistically derived, research is currently being conducted at the University of Alberta using the cut points of ≥12,000 (for girls) and ≥15,000 (for boys) steps per day to determine if health outcomes can be improved in overweight adolescents who achieve these step counts. Longitudinal studies are needed to determine whether achieving these thresholds are beneficial from an obesity prevention or treatment perspective.

2.4.2.4 *Data on Physical Activity of Alberta Children*

Research by Plotnikoff and associates (2004) compared the prevalence of physical inactivity among high school students in urban (n=1407) and rural (n=1290) schools in Ontario and Alberta, respectively. Adherence to Canada's Physical Activity Guide to Healthy Active Living (CPAGHAL) (Health Canada, 1998) was used to assess the prevalence of physical inactivity. Findings revealed that only 57% of students met the CPAGHAL of at least 30 minutes of moderate or 20 minutes of vigorous activity for a minimum of 4 days per week. There was no significant difference between physical inactivity levels of rural and urban high school students.

Many Canadian children are not meeting recommendations for physical activity based on Health Canada's guidelines. This is quite a concern as lack of physical activity is recognized as a risk factor for heart disease. Physical activity also provides many health benefits such as weight control, stress reduction, building strong bones and reducing the risk of diabetes and cancer (Federal, Provincial and Territorial Advisory Committee on Population Health, 1999). In order to increase the lifelong health of Canadians, it is important that healthy physical activity habits are established in childhood.

2.4.2.5 Data on Sedentary Activity of Children

For the purpose of this literature review, sedentary activity refers to physical inactivity which is approximated by measuring screen time. Traditionally, screen time reflected time spent viewing television. Over the past few decades, the definition of screen time has expanded to include television viewing as well as time spent viewing movies and DVDs, working and playing on computers, playing video games and text messaging (Anderson & Bucher, 2006). Today, time spent viewing television is exceeded by video and computer game usage among children (Christakis et al., 2004). A telephone survey (Christakis et al., 2004) conducted with 1,454 parents revealed that children younger than 11 years of age are spending, on average, 1.45 hours watching television and 1.64 hours watching videos and playing computer games combined. According to the 2004 CCHS, 36% of children aged 6-11 reported more than 2 hours of screen time each day. Screen time was defined as viewing television, playing video games and using the computer. Nineteen percent of 12-17 year old children accumulated 30 or more hours of screen time per week, 57% accumulated between 10 and 30 hours per week, and 24% accumulated less than 10 hours per week. In children aged 6-11 years, the prevalence of overweight was higher in those children who viewed >2 hours of screen time compared to those who viewed ≤1 hour (35% *versus* 18%, respectively). Children aged 12-17 years whose weekly screen time amounted to less than 10 hours had a lower overweight and obesity level than those 12-17 year olds whose weekly screen time exceeded 30 hours (23% *versus* 35%, respectively) (Shields, 2005). Sedentary behaviours of youth aged 11-16 years were also very high in a national study by Janssen et al. (2004). Similar to the CCHS data, a strong trend was noted for increased overweight and obesity with increased television viewing time for all youth.

There is evidence that suggests a link between prolonged television viewing and obesity in children (Robinson, 1999; Gortmaker et al., 1996; Anderson et al., 1998). A nationally-representative sample (n=746) of 10-15 year old US boys and girls found that the likelihood of being overweight was 4.6 times greater for children who watched more than 5 hours of television per day compared to those children who watched between 0 and 2 hours per day (Gortmaker et al., 1996). Similarly, Andersen and associates (1998) reported that in a sample (n=4,063) of 8-16 year old children, those who watched 4 or more hours of television per day had a greater body mass index (BMI) and body fat than did those who watched less than 2 hours per day.

Strong evidence is also present in the literature to suggest a link between television, videotape and video game use, and obesity in youth (Tremblay & Willms, 2003; Robinson, 1999). A clinical trial by Robinson (1999) found that children (non-overweight and overweight) in grades 3 and 4 (control, n=121; intervention, n=106) who received a 6-month (18 lesson) theory-based, classroom curriculum intervention designed to reduce TV, videotape and video game usage achieved significant relative decreases in BMI, triceps skinfold thickness, waist circumference and waist-to-hip ratio compared to a control group.

US data have shown that in 1998, 98% of households had a television. By 2000, 41% of households had three or more televisions (French et al., 2001), with 30% of children less than 11 years of age having a television in their bedroom (Christakis et al., 2004). Therefore, it is not surprising that television viewing habits are beginning much earlier in life with 43% of children less than 2 years of age watching television everyday (Rideout et al., 2003). Overall, the average US child between the ages of 2 and 17 years spends more than 3 years watching television once all viewing time is added together (Robinson, 1998).

Many Canadian children exceed maximum screen time recommendations (Health Canada, 2002). This is problematic as increased screen time often leads to decreased physical activity and the negative health effects associated with physical inactivity. It is evident from this literature review that focusing on decreasing children's screen time may represent a worthwhile treatment and/or prevention approach to childhood overweight.

2.4.2.6 Data on Sleep Habits of Children

Child sleep behaviours are often overlooked when examining the overall health of children; however, sleep duration is a very important factor influencing how children think, behave and feel during daytime hours (Wolfson & Carskadon, 1998). Research on US children indicates that between 63% to 87% of adolescents report needing more sleep than they are receiving (Mercer et al., 1998; Wolfson & Carskadon, 1998) and between 10.6% to 11.8% of elementary schoolchildren (4 to 12 years of age) experience daytime sleepiness (Stein et al., 2001; Owens et al., 2000). According to a cross-sectional analysis of child self-reported sleep behaviours, 8 to 11 year old children (n=755) received an average of approximately 9.6 hours of sleep per night (Spilsbury et al., 2004), 0.4 hours less than the recommended 10 to 11 hours per day for 6 to 12 year old children (Owens & Witmans, 2004). Spilsbury and associates (2004) also found that as the age of children increased from 8 to 11 years, significant decreases in sleep duration were identified; with ethnic minority (88% African American) children receiving the least amount of sleep time.

The National Sleep Foundation (2006) "Sleep in America Poll" reported that only 1 in 5 adolescents are receiving the optimal 9 hours of sleep recommended on school nights. On school nights, the survey revealed that 6th grade students are getting an average of 8.4 hours of sleep, while high school seniors are only getting about 6.9 hours. These numbers are of concern as they are well below the minimum recommendations of 10 and 9 hours of sleep needed for 6-11.9 year olds and 12-18 year olds, respectively.

A pilot study conducted in Quebec, Canada revealed a significant association between sleeping hours and childhood overweight and obesity. Chaput and colleagues (2006) measured body weight, height and waist circumference of 422 children between the ages of 5 and 10 years. A telephone questionnaire was also administered to the parents in order to determine the parent-reported sleeping patterns of their children. Results of this study found that short sleeping hours were related to overweight and obesity in children. Gupta and colleagues (2002) found similar results in 11 to 16 year old US children when assessing total sleep time and sleep disturbance time over a 24 hour period. This study found that for every hour of sleep lost, the odds of obesity increased 80%. The same study also revealed that every increased hour of sleep disturbance time was associated with a 3% decrease in daytime physical activity. This suggests that adolescents who experience less disturbed sleep may participate in more daytime physical activity. Findings from these studies are in agreement with previous research of adults (Spiegel et al., 2004;

Taheri et al., 2004) that have suggested sleep duration is important in the regulation of body weight and metabolism by the flux of key appetite regulatory hormones such as leptin and ghrelin. It has been found that short sleep duration is associated with increased ghrelin levels, decreased leptin levels and increased hunger and appetite (Spiegel et al., 2004; Taheri et al., 2004). These findings provide a plausible biological explanation for the relationship between short sleeping hours and overweight and obesity (Chaput et al., 2006). It is paradoxical that sleeping, the most sedentary activity may be linked with leanness (Chaput et al., 2006). However, more research is required to confirm a link between hours of sleep, appetite regulatory hormones and body fatness.

2.4.3 Associations Between Child and Parent/Caregiver Lifestyle Behaviours and Anthropometry

Literature indicates that children's behaviours, perceptions, self esteem and body image are all influenced by environmental factors, family characteristics and parenting styles (Golan & Crow, 2004). Research by Birch & Davison (2001) has also reported that children's eating behaviours are shaped by parent's eating behaviours and weight status. This is not surprising as parents control the availability and accessibility of food, family meal structure and food socialization habits (Golan & Crow, 2004). Physical and sedentary activity behaviours of children can also be influenced by the family environment. Studies have shown that children have higher activity levels if parents provide transportation to after school activities, pay lesson fees, provide community sport memberships (Golan & Crow, 2004; Sallis et al., 1992) or encourage children to be physically active (McGuire et al., 2002). Additional research has also shown that children model food (Vauthier et al., 1996; Patterson et al., 1988; Billon et al., 2002; Fisher & Mitchell, 2002) and activity behaviours of parents (Moore et al., 1991).

Overall, it is evident from the literature that children are products of their family environment. The lifestyle behaviour choices that children make are influenced by those of their parents and other role models. Therefore, it is important to examine the lifestyle behaviours of children and their parents/caregivers when determining effective treatment and/or prevention approaches to childhood overweight.

2.5 SUMMARY OF LITERATURE

The prevalence of childhood overweight is high in Canada. This is a concern as overweight children are at increased risk of many physiological and psychological health consequences and they are at an increased risk of growing up to be overweight adults. Due to the seriousness of this public health issue, it is important to identify feasible and effective prevention and treatment strategies for overweight children.

Although it is known that overweight is a complex condition influenced by genetic, social, behavioural and environmental factors, it is not clear what type of approaches are effective at reversing this condition and/or improving health. Lifestyle behaviours such as eating patterns, physical activity, sedentary activity and sleep habits are thought to be key contributors to the childhood overweight epidemic; however, at the present time, little is known about the lifestyle behaviours of overweight children. As discussed in this literature review, it is evident that Canadian children, in general, have poor lifestyle behaviours, regardless of their weight. Many Canadian children do not meet current recommendations for food intake, activity or sleep duration. This supports the notion that lifestyle behaviours may, in fact, be a key link to the expanding trend of increased body fat in children. In order to understand the prevention and treatment of overweight in children, it is important to examine their lifestyle behaviour habits.

This study will describe the population of overweight children (and their parents/caregivers) in Edmonton, AB, referred to the PCWH at the Stollery Children's Hospital and will determine if they are achieving Canadian recommendations for food intake, physical activity, sedentary activity, and sleep duration. Inter-relationships among child lifestyle behaviours and the relationships between child lifestyle behaviours and anthropometry will be assessed to aid in the further understanding of lifestyle behaviour habits of overweight children. The relationship between parental and child lifestyle behaviours and anthropometry will also be assessed.

CHAPTER THREE
DESIGN AND METHODOLOGY

3.1 ETHICAL APPROVAL

Ethical approval for this study was received from the Health Research Ethics Board (Biomedical Panel A) for the University of Alberta (U of A) Health Sciences Faculties, the Capital Health Authority (CHA), and the Caritas Health Group. Written, informed consent was obtained from each participant's parent/caregiver and written, informed assent was secured from each participant. Only participants who signed the assent forms and whose parents/caregivers completed a consent form were assessed (Appendix A).

NOTE: This thesis represents part of three larger studies that are currently being conducted at the PCWH at the Stollery Children's Hospital. The studies are entitled "The HIP Study" formerly called, "Improving Health Outcomes in Overweight Children with a Family History of Type 2 Diabetes: One-on-One Coaching vs. Group-Based Counselling", "The Clinic Study" and "PLAY/PAC". These study names are stated on all of the consent and assent forms.

3.2 DESIGN

The present study was conducted at the PCWH at the Stollery Children's Hospital. The PCWH is a new regional program of Capital Health. The mission of the PCWH is: "As leaders in pediatric weight management care, we develop and share expertise to promote healthier lifestyles for overweight children and their families". The multi-disciplinary team consists of a registered dietitian, exercise specialist, nurse practitioner, pediatrician, child psychiatrist, child psychologist, community liaison coordinator and secretary.

This study was a cross-sectional design and utilized a convenience sample to assess and describe the population of overweight children in the Edmonton, Alberta area referred for weight management to the PCWH.

3.2.1 Participant Recruitment

The participants involved in the research study were between the ages of 8 and 17 years (including their parents/caregivers) and were referred by their physician to the PCWH for weight management. The grounds for physician referrals included overweight/obesity related weight concerns. Once physician referrals were received, children and their families were invited to attend an information forum regarding the PCWH. At this forum, the PCWH and all research projects were explained in detail, including the commitment of participating families. At the end of the forum, families interested in participating in the PCWH weight management programs scheduled an appointment to begin baseline assessments. Upon their arrival at the PCWH, all parents/caregivers were given information sheets and consent forms to complete while the children were given assent forms. Following the completion of consent and assent forms, baseline assessments were initiated.

3.2.2 Description of Study Population

All children had a BMI $\geq 85^{th}$ percentile according to the CDC growth charts (Centers for Disease Control and Prevention, 2000). Both boys and girls between the ages of 8 and 17 years were eligible for this study; at least one parent/caregiver agreed to play a supportive role during the course of the intervention. Children were not eligible for the study if they tested positive for type 2 diabetes or if they were pregnant. At least one parent/caregiver of each child was also included in this study. In total, data from 45 children (16 boys and 29 girls) and 83 parents/caregivers (44 mothers and 39 fathers) were included in this investigation. The study was a descriptive analysis of a convenience sample of children and their parents/caregivers enrolled in the PCWH; therefore a sample size calculation was not completed.

3.3 METHODOLOGY

The PCWH was launched in January 2006 and data collection for this study occurred from January to December 2006. All data were collected at the PCWH by staff of the PCWH. All measurements were part of the standard baseline assessments completed on the first and second visits to the PCWH prior to the initiation of weight management. The two baseline assessments took place approximately 5-10 days apart.

3.3.1 Physical Exam/Medical History/ Demography

The PCWH pediatrician (or nurse practitioner) conducted a medical history and physical exam. Participants were assessed for stage of sexual maturation according to the guidelines of Marshall and Tanner (Marshall & Tanner, 1970; Marshall & Tanner, 1969). Demographic information included the number of people in the family, family medical history of type 2 diabetes and CVD, and medical history of the child as given by parental report.

3.3.2 Anthropometric Measurements

Height, weight and waist circumference of all children and their parents/caregivers (at least one) were measured by the PCWH exercise specialist. Height was measured to the nearest 0.1cm using a digital stadiometer (SECA, Hanover, MD) and weight was assessed to the nearest 0.1kg using a medical digital balance scale (SECA, Hanover, MD). Height and weight were each measured 3 times and the average of the 3 measurements was recorded. Children were required to take off their shoes for weight and height measurements. Values were then entered into EpiInfo (version 3.3.2.), a software program used to calculate BMI, BMI percentile and BMI Z-scores based on data from the Centers of Disease Control and Prevention (Atlanta, GA). To estimate abdominal fat distribution, waist circumference was measured to the nearest 0.1cm at the narrowest site between the xyphoid process and the iliac crest (Docherty, 1996). Waist circumference measurements, which are simple to perform and easy to reproduce, have been shown to be a promising index of assessing adiposity as well as the best predictor of the metabolic syndrome in children (Maffeis et al., 2003; Moreno et al., 2002; Maffeis et al., 2001a; Maffeis et al., 2001b). In adults, waist circumference has been shown to explain obesity-related health risks (Janssen et al., 2004). Waist measurements were taken at the end of exhalation. During measurements, participants stood with feet positioned close together and arms relaxed at their sides. Measurements were taken over one layer of light clothing using a non-stretch tape measure (Docherty, 1996).

3.3.3 ***Questionnaire***

Parents/caregivers were asked to complete a questionnaire on the eating behaviours of their children in addition to personal information on demography. For the purpose of this thesis, only the following variables will be reported: Place of residence, age, income, and ethnicity. Ethnicity categories were derived from Statistics Canada Census, 2001 (Statistics Canada, 2001). A copy of the questionnaire is provided in Appendix B.

3.3.4 ***Dietary Intake Record***

Dietary intake was measured using a 4-day food record over the same interval that pedometers were worn. All foods and beverages consumed were recorded prospectively over 4 consecutive days, including weekdays and weekend days. Food records are considered the gold standard for dietary assessment, providing an accurate description of an individual's food intake over a specific period (Rockett & Colditz, 1997). The minimum number of days of intake required to determine usual individual intake of energy and macronutrients has been shown to be 3 days (Buzzard, 1998). Based on the literature (Magarey et al., 2001; Block et al., 1990), practicality and consistency with the pedometer data collection, 4-day food records were used.

The PCWH dietitian educated each participant on correct record completion using food models, pictures and sample food records. Parents/caregivers (at least one) of the 8 to 12 year olds and 13 to 17 year olds also recorded their own food intake for the 4 day period. Fewer food records were available for the parents/caregivers of the 13 to 17 year olds as the PCWH did not begin collecting food intake data on these parents/caregivers until the spring of 2006. Families were contacted via telephone during measurement periods to provide support, reinforcement and to answer any questions. The PCWH dietitian reviewed all food records (Appendix C) once they were returned at the second baseline assessment visit to clarify items, validate serving sizes/name brands and maximize data completeness and accuracy. Once the food records were verified, the PCWH dietitian entered all dietary information into The Food Processor Diet Analysis Software SQL program (version 9.8.1) (ESHA Research, Salem, OR). Data were averaged across all 4 days and the average intakes of macro- and micronutrients, calcium, dietary fibre, sugars, American Food Guide Pyramid (Food Pyramid) (USDA, 1992) servings, etc. were calculated (Table 3-1).

3.3.5 *Calculating Canada's Food Guide to Healthy Eating Servings*

Servings from CFGHE (Health Canada, 1992) were calculated manually using the Food Pyramid (USDA, 1992) calculations from Food Processor. The Food Pyramid differs from CFGHE; the Food Pyramid categorizes foods into 6 food groups (Bread, Cereal Rice and Pasta Group; Vegetable Group; Fruit Group; Milk, Yogurt and Cheese Group; Meat, Poultry, Fish, Dry Beans, Eggs and Nuts Group; Fat, Oils and Sweets) whereas CFGHE categorizes food into 4 food groups (Grain Products; Vegetables and Fruit; Milk Products; Meat and Alternatives). For the purpose of this study and our Canadian context, it was important to determine the number of CFGHE servings for each participant rather than the Food Pyramid servings.

In order to calculate the number of CFGHE servings, it was necessary to determine how the Food Pyramid servings were calculated. As described by ESHA Research (http://www.esha.com/nutrition info/support docs), the categories and serving sizes used when calculating the number of Food Pyramid servings were within the recommended serving size ranges for CFGHE. The only differences between the two guides were related to the serving size of fruit and vegetable juices and yogurt. Based on CFGHE, a serving size of fruit and vegetable juice is ½ cup whereas the Food Pyramid categorizes ¾ cup as a serving. The Food Pyramid classifies a serving of yogurt as 245 grams while a CFGHE serving is 175 grams. Therefore, to determine CFGHE servings, the PCWH dietitian and the project coordinator reviewed each Food Processor entry and manually calculated the servings of fruit/vegetable juice and yogurt. Serving size totals were then manually adjusted and added to the Vegetables and Fruit and Milk Products food groups. A description of how servings from the CFGHE compare to the Food Pyramid servings in Food Processor is provided in Table 3-1.

Food Processor includes a "Fats, Oils and Sweets" category with corresponding serving sizes that are not based on the Food Pyramid. Both the Food Pyramid and CFGHE have similar categories ("Other Foods" and "Fats, Oils and Sweets"); however, neither have specific serving size recommendations at this time. Currently, the recommendations for the "Fat, Oils and Sweets" or the "Other Foods" categories include consuming these foods in moderation (Health Canada, 1992; USDA, 1992).. For this reason, Food Processor's "Fats, Oils and Sweets" category and the corresponding serving sizes were included in the analysis for each participant and are referred to in this thesis as the "Others" category.

When Food Processor calculates the Food Pyramid servings from potato chips, hash browns and French fries, the majority of the servings are allocated to the "Fats, Oils and Sweets" category; however, partial servings are also added to the Vegetable Group to account for the potato. Due to this automatic calculation, the project coordinator reviewed each Food Processor entry and manually subtracted the vegetable servings that were added to the Vegetable Group from potato chips, hash browns and French fries. This was done to ensure that only healthy vegetable choices were included as vegetables.

Table 3-1: Description of CFGHE servings derived from the Food Pyramid servings in Food Processor

American Food Guide Pyramid	1 Serving in Food Processor	Canada's Food Guide (CFGHE)	1 Serving based on CFGHE
Bread, Cereal, Rice and Pasta Group	1 slice bread 1 oz cold cereal (28.35g) ½ cup cereal ½ cup rice ½ cup rice noodles ½ cup pasta	**Grain Products**	1 slice bread ½ cup (125ml) cold cereal (30g) ¾ cup (175ml) hot cereal ½ bagel, pita, bun ½ cup rice ½ cup pasta
Vegetable Group	1 cup raw leafy vegetables ½ cup cooked, canned or chopped vegetables ¾ cup vegetable juice	**Vegetables and Fruit**	1 medium fruit or vegetable ½ cup (125ml) fresh, frozen or canned fruit or vegetable 1 cup (250ml) salad ½ cup (125ml) fruit or vegetable juice
Fruit Group	1 medium fruit ½ cup chopped, cooked or canned fruit ¾ cup fruit juice		
Milk, Yogurt, and Cheese Group	1 cup milk 1 cup yogurt 1.5 oz cheese (43 – 56.7 grams)	**Milk Products**	1 cup (250ml) milk ¾ cup (175ml) yogurt 50 grams cheese (2 slices, ~2oz)
Meat, Poultry, Fish, Dry Beans, Eggs and Nuts Group	2.5 oz cooked lean meat, poultry, fish, vegetarian meat substitute (71g) ½ cup cooked dry beans	**Meat and Alternatives**	50-100grams (~2-3oz) meat, fish, poultry ½-1 cup (125-250ml) beans 1 egg

	1 egg 1/3 cup nuts 2 tbsp peanut butter		1/3 cup (100grams) tofu 1/3 cup nuts 2 tbsp (30ml) peanut butter
Fats, Oils and Sweets	1 serving of fat = number of grams in 1 tbsp of fat (butter, margarine, oils, shortening) 1 serving of fat for meat = an additional fat serving as a multiple of the fat standard for the specific meat 1 serving of fat for milk products and mixed foods = an additional fat serving as a multiple of 12.8 grams 1 serving of sugar = number of grams in 1 tsp sugar (4 grams) The Food Guide Pyramid lists no specific recommended amounts.	**Other Foods**	Foods and beverages not included as part of the 4 food groups. Some of these foods are higher in fat or calories. Moderate consumption is recommended. The CFGHE lists no specific recommended amounts.

3.3.6. *Physical Activity – Pedometer*

The Yamax Digi-Walker DW-200 pedometer (Tokyo, Japan) was used to assess physical activity over the same 4 day interval that food records were recorded and included both weekdays and weekend days. Research using accelerometers suggests that 4 to 7 days of objective monitoring are required to estimate reliable daily physical activity in children (Trost et al., 2000). Due to cost, time restraints, and participant burden, pedometers were used to estimate children's physical activity levels over 4 days. The Yamax Digi-Walker DW-200 pedometer was chosen for this study because it has been validated in children (Eston et al., 1998), is objective, accurate (Bassett et al., 1996) and simple to use. However, it is important to note that excessive abdominal adiposity may interfere with accurate pedometer readings by incorrect placement or by reducing the force of vertical accelerations (Tudor-Locke et al., 2002).

The PCWH exercise specialist demonstrated correct pedometer placement for participants, details regarding step recording and care for the unit. Families were telephoned during measurement periods to provide support, reinforcement and to answer any questions that they had. During measurement intervals, children recorded the number of steps that they took daily and the hours in which they wore their pedometers each day. The parents/caregivers of the 8 to 12 year olds and 13 to 17 year olds also recorded their own number of steps per day for this 4 day period. Fewer step records were available for the parents/caregivers of the 13 to 17 year olds as the PCWH did not begin collecting step data on these parents/caregivers until the spring of 2006. Step log books (Appendix C) were returned and reviewed by the PCWH exercise specialist at the second baseline assessment visit.

3.3.7 Physical Activity – Recall (PAR)

Pedometers are unable to measure physical activity intensity; therefore, the 7-Day Physical Activity Recall (PAR) interview was used to assess participants' time spent in moderate-to-vigorous physical activity (MVPA). The PAR interview provides valid and reliable estimates of moderate (3.0–4.9 METs), hard (5.0-6.9 METs) and very hard (≥7.0 METs) physical activity (equivalent to MVPA) in 10 to 16 year old (active, inactive, heavy and lean) children (Sallis et al., 1993). MVPA is a measure of physical activity intensity, and has been shown to be inversely associated with overweight in children (Gordon-Larsen et al., 2002; Trost et al., 2001). For the purpose of this study moderate physical activity was estimated based on the amount of moderate activity (3.0–4.9 METs) participants achieved. Vigorous physical activity was estimated based on the total amount of hard (5.0-6.9 METs) and very hard (≥7.0 METs) physical activity achieved by each participant. To prevent inter-rater error, the PCWH exercise specialist conducted all of the recall interviews. A copy of the PAR questionnaire is provided in Appendix D.

3.3.8 Sedentary Activity – Recall

The literature has devoted little attention to the measurement of sedentary activity (Gordon-Larsen et al., 2002) and there are no known published reports of valid or reliable tools to assess sedentary activity. Therefore, for convenience and ease, the PCWH exercise specialist measured children's total screen time (TV, computer, video game) and sleep time over the same 7-day period as the PAR. A copy of the sedentary activity recall questionnaire is provided in Appendix D.

3.4 STATISTICAL ANALYSIS

Statistical analyses were performed using the software program Statistical Package for the Social Sciences (SPSS) for Windows version 14.0 (Chicago, IL). All data were transferred to SPSS files from a Microsoft® Excel spreadsheet. Nutrition data entered into Food Processor were verified for accuracy and completeness by the study coordinator and the PCWH registered dietitian. Descriptive statistics were used to explore the distribution of variables and assess data normality. Parametric analyses were conducted with normally distributed data; non-normal variables (i.e. total physical activity, vigorous physical activity, moderate physical activity, video game time and computer time) were log transformed prior to analyses.

Means, standard deviations and ranges were determined for child age (years), height (cm), weight (kg), BMI (kg/m^2), BMI percentiles (%), waist circumference (cm), moderate, vigorous and total physical activity (minutes/day), sleep (hours/day), and television, video game, computer and total screen time (minutes/day). Mean, standard deviations and ranges were also determined for parents/caregivers age (years), height (cm), weight (kg), BMI (kg/m^2) and waist circumference (cm). As well, means, standard deviations and ranges were determined for parents/caregivers and child energy intake (kcal/day), Grain Products (servings/day), Vegetables and Fruit (servings/day), Milk Products (servings/day), Meat and Alternatives (servings/day), Other Foods (servings/day) and steps (steps/day).

The independent samples t-test or Mann-Whitney U test (nonparametric) was used to determine differences among genders. Non-parametric data were log transformed prior to correlation and analysis of covariance (ANCOVA) analyses. Pearson correlation coefficients were generated to determine relationships between child and/or parent/caregiver lifestyle behaviours and anthropometry. When gender differences were observed, partial correlations were used to adjust for this covariate. Gender was used as a control variable when Vegetables and Fruit intake, total screen time, video game time and WC were analyzed. Independent samples t-tests and ANCOVA were used to examine differences in child and/or parent/caregiver lifestyle behaviours and anthropometry between children who met or failed to meet lifestyle behaviour recommendations. Variables were chosen for dichotomisation based on significant p-values derived from the correlation analyses. Group differences and correlations were considered significant at $p < 0.05$.

CHAPTER FOUR
RESULTS

4.1 PARTICIPANT RECRUITMENT

All children referred to the PCWH for weight management and their parents/caregivers were eligible for this study. Consent and assent forms were completed for all parents/caregivers and children, respectively, attending the PCWH. In total, data on 45 children (16 males, 29 females) and 83 parents/caregivers (44 mothers, 39 fathers) were included in these analyses.

Ninety nine participants (45 children and 54 parents/caregivers) were measured for height, weight, BMI and waist circumference (WC). Data on food intake were available for all 45 child participants and 33 parents/caregivers (25 mothers, 8 fathers). Mean number of steps per day were available for 44 children and 34 parents/caregivers. Due to 4 invalid PAR questionnaires (see Appendix D), minutes of physical activity, sedentary activity (screen time), and hours of sleep were available for 42, 44, and 43 children, respectively. Data on the minutes of physical activity and sedentary activity and hours of sleep for parents/caregivers were not collected.

Due to the limited lifestyle behaviour information available on fathers, only maternal data were used for statistical analyses using parent/caregiver information. Prior to performing correlations between maternal and child anthropometry and lifestyle behaviours, child and maternal data were matched. For example, BMI and WC measures were available for 40 mothers, therefore only the children of those mothers (*n* = 40) were included in the correlation matrix rather than the total population of children (*n* = 45).

4.2 PARTICIPANT CHARACTERISTICS

4:2.1 Children

Table 4-1: Demographic and anthropometric characteristics of children

Variable	Overall $n = 45$	Females $n = 29$	Males $n = 16$	p-value[ad]
Age (years)	13.5 ± 2.4[b] (9.1-17.9)[c]	13.5 ± 2.6 (9.1-17.9)	13.5 ± 2.2 (9.9-16.6)	.956
Height (cm)	161.5 ± 11.7 (138.5-182.6)	159.2 ± 10.4 (138.5-174.7)	165.8 ±13.1 (147.1-182.6)	.071
Weight (kg)	90.6 ± 25.8 (43.3-157.7)	84.4 ± 20.3 (43.3-124.2)	101.7 ± 31.3 (60.3-157.7)	**.030**
BMI (kg/m^2)	34.0 ± 6.1 (22.6-49.8)	32.8 ± 5.3 (22.6-45.8)	36.2 ± 6.9 (26.9-49.8)	.079
BMI %iles	98.4 ± 1.8 (91.5-99.9)	98.0 ± 2.1 (91.5-99.9)	99.1 ± 0.8 (97.0-99.8)	**.009**[e]
BMI z-score	2.3 ± 0.4 (1.4-2.9)	2.2 ± 0.3 (1.37-2.7)	2.5 ± 0.3 (1.9-2.9)	**.004**
WC (cm)	101.2 ± 13.0 (76.0-136.6)	95.9 ± 10.5 (76.0-114.9)	110.8 ± 11.8 (95.5-136.6)	**<.001**

[a] Comparison of females to males

[b] Mean ± standard deviation

[c] Range

[d] Independent sample t-tests

[e] Mann-Whitney U test

As shown in Table 4-1, boys were significantly heavier (p=.030) and had higher BMI percentiles (p=.009), BMI z-scores (p=.004) and WC (p<.001) than girls. No significant differences were found between males and females for age, height and BMI. Of the 45 children involved in this study, 80% were Caucasian while the remaining 20% were Aboriginal, Black, Southeast Asian or Arab.

4.2.1.1 Food Intake

Table 4-2: Average daily energy intake and food group servings of children

Variable	Overall *n* = 45	Females *N* = 29	Males *n* = 16	CFGHE Recommendation	p-value[a]
Grain Products (servings/day)	9.8 ± 5.1[b] (0.0-28.9)[c]	8.5 ± 4.3 (0.0-23.7)	12.2 ± 5.6 (7.2-28.9)	≥5 servings/day	.334[g]
Vegetables and Fruit (servings/day)	4.0 ± 2.0 (0.9-10.8)	4.4 ± 2.1 (1.7-10.8)	3.2 ± 1.7 (0.9-7.5)	≥5 servings/day	**.044[g]**
Milk Products (servings/day)	2.3 ± 1.3 (0.0-5.9)	2.0 ± 0.9 (0.0-4.2)	2.9 ± 1.6 (0.8-5.9)	≥2 servings/day[d] ≥3 servings/day[e] ≥2 servings/day[f]	.224[g]
Meat and Alternatives (servings/day)	2.1 ± 1.0 (0.3-5.0)	2.1 ± 1.1 (0.3-5.0)	2.3 ± 0.9 (0.6-4.1)	≥2 servings/day	.996[g]
Others (servings/day)	28.6 ± 19.5 (0.0-102.1)	23.8 ± 12.3 (0.0-54.9)	37.0 ± 26.8 (9.1-102.2)	moderate intake	.503[g]
Total Energy (kcal/day)	2430 ± 831 (339-4906)	2212 ± 761 (339-4206)	2826 ± 829 (1917-4906)	-	**.016[h]**

[a] Comparison of females to males

[b] Mean ± standard deviation

[c] Range

[d] Recommendation for children 4-9 years of age (Health Canada, 1992)

[e] Recommendation for children 10-16 years of age (Health Canada, 1992)

[f] Recommendation for children 17 and older (Health Canada, 1992)

[g] Analysis of covariance controlled for child total energy

[h] Independent sample t-tests

Males consumed significantly more calories than females (2826 ± 829 *versus* 2212 ± 761 kcals) (p=.016). Significant differences were also noted between females and males for intake of Vegetables and Fruit servings. No significant differences were noted between males and females for intake of Grain

Products, Milk Products, Meat and Alternatives and Others. The mean servings of Vegetables and Fruit were below the CFGHE recommendation at 4.4 ± 2.1 for females and 3.2 ± 1.7 for males. Children, on average, met or exceeded the CFGHE serving recommendations for Grain Products, Milk Products and Meat and Alternatives. Intakes of Others were high at 23.8 ± 12.3 servings for females and 37.0 ± 26.8 servings for males.

4.2.1.2 *Physical Activity – Quantity and Quality*

Table 4-3: Steps and minutes of physical activity per day of children

Variable	Overall *n* = 45	Females *N* = 29	Males *n* = 13	Physical Activity Recommendation	p-value[a]
Total Physical Activity (minutes/day)	49.0 ± 33.5[b] (0.0-154.3)[c]	49.7 ± 27.7 (0.0-113.6)	47.5 ± 45.2 (8.6-154.3)	≥90 minutes/day[d]	.215[d]
Vigorous Physical Activity (minutes/day)	18.8 ± 16.2 (0.0-64.3)	20.1 ± 17.0 (0.0-64.3)	15.8 ± 14.5 (0.0-47.1)	≥30 minutes/day[d]	.413[d]
Moderate Physical Activity (minutes/day)	30.2 ± 24.9 (0.0-128.6)	29.6 ± 17.9 (0.0-72.9)	31.6 ± 37.0 (6.4-128.6)	≥60 minutes/day[e]	.191[d]
Steps[g] (steps/day)	7160 ± 3230 (1047-14399)	7131 ± 3222 (1969-14399)	7216 ± 3360 (1047-11877)	≥12,000 steps/day[f] ≥15,000 steps/day[f]	.936[h]

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[a] Comparison of females to males

[b] Mean ± standard deviation

[c] Range

[d] Mann-Whitney U test

[e] Recommendations based on CPAGCY (Health Canada, 2002)

[f] Recommendations for females based on Tudor-Locke et al. (2004)

[f] Recommendations for males based on Tudor-Locke et al. (2004)

[g] *n* = 44 (*n*= 29 females, *n* = 15 males)

[h] Independent sample t-tests

No significant differences were noted between males and females for quality or quantity of physical activity (Table 4-3). The mean number of minutes per day of moderate, vigorous and total physical activity for females and males did not meet recommendations based on CPAGCY (Health Canada, 2002). Steps per day were also below recommendations base on Tudor-Locke and associates (2004) with females and males only meeting an average of 7131 ± 3222 steps per day and 7216 ± 3360 steps per day, respectively.

4.2.1.3 *Sedentary Activity – Screen Time and Sleep Habits*

Table 4-4: Sleep time hours and minutes of screen time per day of children

Variable	Overall *n* = 45	Females *n* = 29	Males *n* = 15	Sedentary Activity Recommendation	p-value[a]
Total Sleep[f] Time (hours/day)	9.3 ± 1.1[b] (6.7-11.4)[c]	9.4 ± 0.9 (7.4-11.4)	9.0 ± 1.2 (6.7-11.1)	≥9 hours/day[d] ≥10 hours/day[e]	.202[h]
Screen Time (minutes/day)	203.3 ± 126.0 (23.6-548.6)	176.2 ± 104.0 (23.6-424.3)	255.9 ± 150.6 (45.0-548.6)	≤90 minutes/day	**.045[h]**
Television (minutes/day)	125.9 ± 87.0 (0.0-347.1)	116.1 ± 78.8 (0.0-347.1)	145.1 ±101.3 (17.1-278.6)	-	.342[h]
Video Game (minutes/day)	21.1 ± 51.2 (0.0-291.4)	6.1 ± 19.2 (0.0-98.6)	50.0 ± 77.2 (0.0-291.4)	-	**.001[g]**
Computer (minutes/day)	56.3 ± 76.0 (0.0-360.0)	53.9 ± 63.2 (0.0-248.6)	60.7 ± 98.7 (0.0-360.0)	-	.804[g]

[a] Comparison of females to males

[b] Mean ± standard deviation

[c] Range

[d] Recommendation for 12 to 18 year olds (Owens & Witmans, 2004; National Institutes of Health, 2003; Carskadon et al., 1980)

[e] Recommendation for 6 to 11.9 year olds (Owens & Witmans, 2004)

[f] *n* = 43 (*n*= 29 females, *n* = 14 males)

[g] Mann-Whitney U test

[h] Independent sample t-tests

As seen from Table 4-4, the mean hours of sleep for males (9.0 ± 1.2) and females (9.4 ± 0.9) were within the recommendations for 6-11.9 year old children; however, the mean did not meet the 12-18 year old recommendations (Owens & Witmans, 2004). On average, children did not meet the total screen time recommendations of ≤90 minutes per day. Significant differences were seen between genders for minutes per day of video game time and total screen time.

4.2.2 Parents/Caregivers

Table 4-5: Demographic and anthropometric characteristics of parents/ caregivers

Variable	Mothers	Fathers
	n = 40	*n* = 14
Age (years)[c]	42.7 ± 7.6[a]	44.1 ± 6.8
	(28.0-69.0)[b]	(31.0-60.0)
Height (cm)	164.2 ± 5.6	176.9 ± 8.2
	(147.3-175.5)	(162.8-191.7)
Weight (kg)	93.8 ± 27.2	103.6 ± 30.3
	(46.9-168.1)	(67.0-163.7)
BMI (kg/m^2)	34.7 ± 9.7	32.7 ± 7.7
	(17.6-65.1)	(22.9-49.6)
WC (cm)	99.7 ± 18.6	107.8 ± 18.2
	(69.6-146.3)	(78.1-151.2)

[a] Mean ± standard deviation

[b] Range

[c] *n* = 83 (*n*= 44 females, *n* = 39 males)

On average, fathers were older, taller and weighed more than mothers. Fathers had higher WC than mothers; however, maternal BMI exceeded paternal BMI (Table 4-5). Statistical group comparisons between mothers and fathers were not completed due to the low number of father participants.

Overall, 62.2% of parents/caregivers were married or common law, 31.1% were separated or divorced, 4.4% were widowed and 2.2% were never married (*n*= 45). Data on the education level of mothers revealed that 72.2% had some post secondary education (*n* = 26/36), 22.2% were high school graduates and 5.6% had not completed high school. Education level was only available for 10 fathers and indicated that all had some post secondary education. Ethnicity of the parent/caregiver sample was primarily Caucasian (*n* = 32/39 mothers, *n* = 15/17 fathers).

4.2.2.1 Food Intake

Table 4-6: Total energy intake and food group servings of parents/ caregivers

Variable	Mothers *n* = 25	Fathers *n* = 8	CFGHE Recommendation
Grain Products (servings/day)	6.4 ± 2.5[a] (1.1-11.6)[b]	9.9 ± 2.7 (6.3-13.6)	≥5 servings/day
Vegetables and Fruit (servings/day)	4.0 ± 1.5 (0.8-6.8)	4.7 ± 1.9 (2.6-7.7)	≥5 servings/day
Milk Products (servings/day)	1.4 ± 0.8 (0.1-2.8)	1.7 ± 0.9 (0.3-2.9)	≥2 servings/day
Meat and Alternatives (servings/day)	2.2 ± 0.9 (0.7-3.9)	3.7 ± 1.7 (1.1-6.9)	≥2 servings/day
Others (servings/day)	15.2 ± 7.8 (1.2-36.9)	24.4 ± 12.4 (10.3-44.5)	moderate intake
Total Energy (kcal/day)	1784 ± 489 (810-2841)	2828 ± 736 (1818-3921)	-

[a] Mean ± standard deviation

[b] Range

Although statistical analyses were not performed due to the limited amount of paternal dietary data, mean total calories and overall CFGHE serving intakes were greater in fathers *versus* mothers. The average servings of Vegetables and Fruit and Milk Products for mothers and fathers were both below the CFGHE recommendations. In contrast, mean servings of Grain Products and Meat and Alternatives met CFGHE recommendations. Average intake of Others for mothers and fathers were lower than the mean intakes for children, with mothers consuming the least amount.

4.2.2.2 *Physical Activity – Quantity*

Table 4-7 presents the means, standard deviations and ranges of the quantity (steps per day) of physical activity for mothers and fathers. Similar to child step recommendations, mean steps of both mothers and fathers did not meet physical activity step recommendations.

Table 4-7: Steps per day of parents/caregivers

Variable	**Mothers** ***n* = 26**	**Fathers** ***n* = 8**	**Physical Activity Recommendation**
Steps (steps/day)	7096 ± 2776[a] (2454-13385)[b]	8631 ± 4663 (2865-16081)	≥10,000 steps/day[c]

[a] Mean ± standard deviation

[b] Range

[c] Recommendation for adult males and females (Tudor-Locke and Bassett, 2004)

4.3 *LIFESTYLE BEHAVIOUR RECOMMENDATIONS*

4.3.1 *Children*

Table 4-8: Number and percentage of lifestyle behaviour recommendations met by children

Variables	**Overall** *n* **= 45** *(%)*	**Females** *n* **= 29** *(%)*	**Males** *n* **= 16** *(%)*
Grain Products (servings/day)	43 (95.6%)	27 (93.1%)	16 (100%)
Vegetables and Fruit (servings/day)	13 (28.9%)	11 (37.9%)	2 (12.5%)
Milk Products (servings/day)	15 (33.3%)	7 (24.1%)	8 (50.0%)
Meat and Alternatives (servings/day)	21 (46.7%)	12 (41.4%)	9 (56.3%)
Physical Activity (minutes/day)	5 (11.1%)	2 (6.9%)	3 (23.1%)[a]
Steps (steps/day)	2 (4.4%)	2 (6.9%)	0 (0.0%)[b]
Screen Time (minutes/day)	11 (24.4%)	8 (27.6%)	3 (20.0%)[b]
Sleep Time (hours/day)	21 (46.7%)	15 (51.7%)	6 (42.9%)[c]

[a] *n* = 13 males

[b] *n* = 15 males

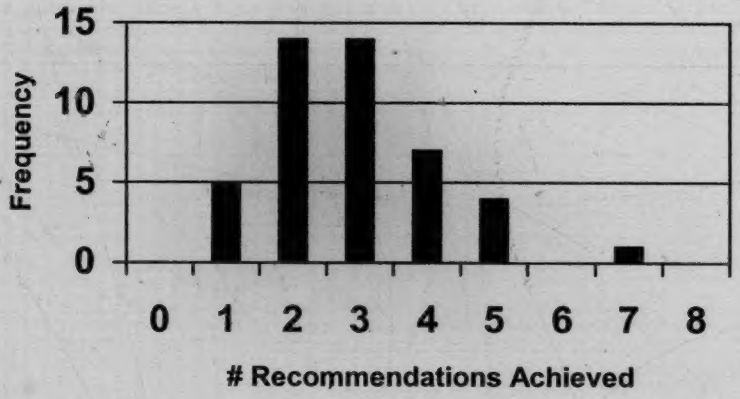
[c] *n* = 14 males

As seen form Table 4-8, the Grain Products recommendation was met by most children (93% female, 100% male). Meat and Alternatives and sleep recommendations were achieved by nearly half of the female and male study sample. Fifty percent of males and 24% of females met the Milk Products recommendation with only 12.5% of males and 38% of females meeting the

Vegetables and Fruit recommendation. Total screen time recommendation was achieved by 28% of females and 20% of males while the physical activity recommendation was only met by 7% of females and 23% of males. Achievement of the step recommendation was very low for both females (7%) and males (0%).

Figure 4-1 presents the number of child study participants who satisfied the 8 different lifestyle behaviour recommendations (food intake, physical activity, sedentary activity and sleep recommendations).

Figure 4-1: Lifestyle behaviour recommendations met by children



Approximately 73% of children achieved 3 or fewer of the 8 lifestyle behaviour recommendations. Overall, 96% of children met the CFGHE Grain Products recommendation, 47% met the Meat and Alternatives recommendation 33% met the Milk Products recommendation and 29% met the Vegetables and Fruit recommendation. Total physical activity recommendations were achieved by 12% of children while step recommendations were met by only 5% of children. Achievement of the sedentary recommendation was low with 25% of children receiving ≤90 minutes of screen time per day. Sleep recommendations were met by 49% of all children; 50% of 9 to 11.9 year olds and 48% of 12 to 18 year olds met their age-specific sleep recommendation.

4.3.2 Parents/Caregivers

Table 4-9 presents the total number of mothers and fathers who met the lifestyle behaviour recommendations for food intake and physical activity (quantity). The percentage of each population appears in brackets.

Table 4-9: Number and percentage of lifestyle behaviour recommendations met by parents/caregivers

Variables	**Mothers** ***n* = 25 (%)**	**Fathers** ***n* = 8 (%)**
Grain Products (servings/day)	19 (76.0%)	8 (100.0%)
Vegetables and Fruit (servings/day)	8 (32.0%)	3 (37.5%)
Milk Products (servings/day)	5 (20.0%)	3 (37.5%)
Meat and Alternatives (servings/day)	13 (52.0%)	7 (87.5%)
Steps (steps/day)	6 (23.1%)[a]	2 (25.0%)

[a] *n* = 26 females

As seen from Table 4-9, 100% of fathers and 76% of mothers achieved the Grain Products recommendation. Vegetables and Fruit and Milk Products recommendations were met by 38% of fathers while a smaller proportion of mothers achieve the Vegetables and Fruit (32%) and Milk Products (20%) recommendations. Meat and Alternatives recommendation was met by 88% of fathers and 52% of mothers. The step recommendation was met by approximately 25% of the parents/caregivers.

Due to the limited amount of demographic, anthropometric and lifestyle behaviour information available on fathers, only maternal characteristics were used in the statistical analyses involving children and parents/caregivers.

4.4 *ANTHROPOMETRIC AND LIFESTYLE BEHAVIOUR RELATIONSHIPS*

4.4.1 Inter-Relationships Between Child Lifestyle Behaviours

Correlations and partial correlations were performed to determine inter-relationships between all child lifestyle behaviours. Correlation results revealed significant, negative relationships between Grain Products and steps (r=-.307, p=.043), total physical activity (r=-.389, p=.012) and moderate physical activity (r=-.319, p=.042). Positive correlations were noted between Grain Products and television time (r=.485, p=.001) and total screen time (r=.577, p<.001). Milk Products and sleep (r=.351, p=.021) were positively correlated while Meat and Alternatives and sleep (r=-.304, p=.048) were inversely correlated. Positive correlations were revealed between Meat and Alternatives and computer time (r=.479, p=.003) and total screen time (r=.359, p=.017) Intake of Others was also positively related to television (r=.462, p=.002) and total screen time (r=.372, p=.013). No other significant correlations were noted between child lifestyle behaviours.

No significant partial correlations were found between child dietary intake and child total, moderate and vigorous physical activity or steps per day (Table 4-10). Significant negative correlations were noted between total screen time and intake of Milk Products (r=-.449, p=.003) as well as computer time and intake of Milk Products (r=-.410, p=.015) (Table 4-11). Total hours of sleep and intake of Meat and Alternatives were also significantly negatively correlated (r=-.316, p=.041). Positive correlations were noted between intake of Milk Products and hours of sleep (r=.413, p=.007) as well as intake of Meat and Alternatives and minutes of computer time (r=.478, p=.004). A positive trend was revealed between intake of Grain Products and total screen time (r=.304, p=.051). Table 4-12 reveals significant, negative correlations between total screen time and total physical activity (r=-.357, p=.024) and moderate physical activity (r=-.341, p=.031) as well as total screen time and steps per day (r=-.433, p=.004). Minutes of television time per day were also negatively correlated with total physical activity (r=-.443, p=.004), vigorous physical activity (r=-.396, p=.015) and moderate physical activity (r=-.316, p=.044) in our child study sample. A negative trend was seen between moderate physical activity and video game time (r=-.462, p=.083). In addition, duration of sleep was positively related to total physical activity (r=.348, p=.026).

Table 4-10: Correlations between child dietary and physical activity-related variables

	Grain Products[a] (servings/day)	Vegetables and Fruit[ab] (servings/day)	Milk Products[a] (servings/day)	Meat and Alternatives[a] (servings/day)	Others[a] (servings/day)
Total Physical Activity[c] (minutes/day)	-.284 (p=.076)	.243 (p=.137)	.244 (p=.129)	-.008 (p=.960)	.033 (p=.840)
Vigorous Physical Activity[c] (minutes/day)	-.246 (p=.148)	.007 (p=.970)	.159 (p=.355)	-.069 (p=.689)	-.001 (p=.995)
Moderate Physical Activity[c] (minutes/day)	-.176 (p=.278)	.184 (p=.261)	.260 (p=.105)	.105 (p=.520)	-.033 (p=.839)
Steps (steps/day)	-.252 (p=.104)	.049 (p=.758)	.278 (p=.071)	-.104 (p=.507)	.083 (p=.598)

[a] Controlled for total energy intake

[b] Controlled for gender

[c] Data were log transformed prior to analyses

Table 4-11: Correlations between child dietary and sedentary activity-related variables

	Grain Products[a] (servings/day)	Vegetables and Fruit[ab] (servings/day)	Milk Products[a] (servings/day)	Meat and Alternatives[a] (servings/day)	Others[a] (servings/day)
Total Screen Time[b]	.304	.001	-.449	.254	-.083
(minutes/day)	(p=.051)	(p=.996)	**(p=.003)**	(p=.104)	(p=.601)
Television	.187	-.027	-.091	-.033	.118
(minutes/day)	(p=.231)	(p=.867)	(p=.563)	(p=.836)	(p=.449)
Video Game[bc]	-.113	.186	-.303	-.107	.003
(minutes/day)	(p=.655)	(p=.474)	(p=.236)	(p=.684)	(p=.992)
Computer[c]	.134	.053	-.410	.478	-.187
(minutes/day)	(p=.444)	(p=.765)	**(p=.015)**	**(p=.004)**	(p=.281)
Total Sleep Time	.035	.123	.413	-.316	-.058
(hours/day)	(p=.824)	(p=.444)	**(p=.007)**	**(p=.041)**	(p=.714)

[a] Controlled for total energy intake

[b] Controlled for gender

[c] Data were log transformed prior to analyses

Table 4-12: Correlations between child sedentary and physical activity-related variables

	Total Screen Time[a] (minutes/day)	**Television (minutes/day)**	**Video Game[ba] (minutes/day)**	**Computer[b] (minutes/day)**	**Total Sleep Time (hours/day)**
Total Physical Activity[b] (minutes/day)	-.357 **(p=.024)**	-.443 **(p=.004)**	-.109 (p=.698)	-.205 (p=.252)	.348 **(p=.026)**
Vigorous Physical Activity[b] (minutes/day)	-.218 (p=.201)	-.396 **(p=.015)**	.036 (p=.906)	.015 (p=.937)	.214 (p=.204)
Moderate Physical Activity[b] (minutes/day)	-.341 **(p=.031)**	-.316 **(p=.044)**	-.462 (p=.083)	-.259 (p=.145)	.147 (p=.358)
Steps (steps/day)	-.433 **(p=.004)**	-.207 (p=.177)	-.166 (p=.511)	-.246 (p=.639)	-.069 (p=.662)

[a] Controlled for gender

[b] Data were log transformed prior to analyses

4.4.2 Relationships Between Child Lifestyle Behaviours and Child Anthropometry

Correlation analysis revealed that Grain Products were positively correlated with BMI (r=.546, p<.001) and WC (r=.533, p<.001). Meat and Alternatives (r=.370, p=.012), computer time (r=.381, p=.022) and total screen time (r=.487, p=.001) were also positively correlated with BMI, while Others (r=.327, p=.028), video game (r=.477, p=.039) and total screen time (r=.491, p=.001) were positively related to WC. Negative correlations were noted between WC and sleep (r=-.304, p=.002) and WC and vigorous physical activity (r=-.340, p=.002). In addition, inverse relationships were revealed between BMI and moderate physical activity (r=-.355, p=.023), vigorous physical activity (r=-.396, p=.015), total physical activity (r=-.375, p=.016), and sleep (r=-.462, p=.002). No other significant correlations where noted between child lifestyle behaviours and anthropometric variables.

Partial correlations were performed to determine relationships after controlling for the effect of gender and/or total calories. Table 4-13 presents the correlations between child lifestyle behaviours, BMI and WC. Results showed a significant positive correlation between child BMI and WC (r=.877, p<.001). Findings also revealed significant positive correlations between child BMI and Grain Products (r=.386, p=.010), total screen time (r=.436, p=.003) and computer time (r=.381, p=.022) as well as child WC and total screen time (r=.406, p=.007) and computer time (r=.386, p=.022). Positive trends were also noted between child BMI and television time (r=.288, p=.058) and child BMI and Meat and Alternatives intake (r=.290, p=.056). Significant negative relationships were seen between child BMI and Milk Products (r=-.364, p=.015) as well as child WC and Milk Products (r=-.330, p=.030). Negative relationships were also found between child BMI and total physical activity (r=-.375, p=.016), vigorous physical activity (r=-.396, p=.015) and moderate physical activity (r=-.355, p=.023). Hours of sleep and BMI (r=-.462, p=.002) were also negatively related as was WC and sleep (r=-.890, p=.017) and WC and vigorous physical activity (r=-.339, p=.043).

In addition, independent sample t-tests or ANCOVA (Table 4-14) revealed that children who did not achieve the Milk Products (p=.025), total physical activity (p=.009) or screen time recommendations (p=.009) had significantly higher BMI's *versus* children who satisfied these recommendations. A trend was also noted in that BMI was higher in children who did not meet the Vegetables and Fruit recommendation *versus* those children who did meet this recommendation (p=.075). No significant BMI differences were noted between children who met and did not meet the sleep recommendation.

Table 4-13: Correlations between child lifestyle behaviours and child BMI and WC

	BMI (kg/m^2)	WC (cm)[b]
BMI (kg/m^2)	-	.877 **(P<.001)**
Grain Products[a] (servings/day)	.386 **(p=.010)**	.237 (p=.126)
Vegetables and Fruit[ba] (servings/day)	-.199 (p=.201)	-.147 (p=.348)
Milk Products[a] (servings/day)	-.364 **(p=.015)**	-.330 **(p=.030)**
Meat and Alternatives[a] (servings/day)	.290 (p=.056)	.201 (p=.197)
Others[a] (servings/day)	-.145 (p=.348)	-.132 (p=.400)
Total Physical Activity[c] (minutes/day)	-.375 **(p=.016)**	-.221 (p=.171)
Vigorous Physical Activity[c] (minutes/day)	-.396 **(p=.015)**	-.339 **(p=.043)**
Moderate Physical Activity[c] (minutes/day)	-.355 **(p=.023)**	-.199 (p=.219)
Steps (steps/day)	-.226 (p=.141)	-.261 (p=.091)
Total Screen Time[b] (minutes/day)	.436 **(p=.003)**	.406 **(p=.007)**
Television (minutes/day)	.288 (p=.058)	.069 (p=.896)
Video Game[c] (minutes/day)	.277 (p=.266)	.340 (p=.167)
Computer (minutes/day)[c]	.381 **(p=.022)**	.386 **(p=.022)**
Total Sleep (hours/day)	-.462 **(p=.002)**	-.442 **(p=.003)**

[a] Controlled for total energy intake

[b] Controlled for gender

[c] Data were log transformed prior to analyses

Table 4-14: BMI differences between children who did or did not meet Vegetables and Fruit, Milk Products, total physical activity, screen time and sleep recommendations

	Met	*N*	BMI (kg/m^2)	F	p-value[b]
Vegetables/Fruit Recommendation	YES	13	31.6[a]	3.3	.075
	NO	32	34.9		
- Total Energy[d]	-	-	-	6.8	**.013**
- Gender[e]	-	-	-	0.2	.684
Milk Products Recommendation	YES	15	31.3	5.4	**.025**
	NO	30	35.3		
- Total Energy[d]	-	-	-	13.4	**.001**
Screen Time Recommendation	YES	11	30.2	7.4	**.009**
	NO	33	35.4		
- Gender[e]	-	-	-	3.7	.060
	Met	***N***	**BMI (kg/m^2)**	**T**	**p-value[c]**
Total Physical Activity Recommendation	YES	5	27.8	2.7	**.009**
	NO	37	35.3		
Sleep Recommendation	YES	21	33.7	0.5	.604
	NO	22	34.6		

[a] Estimated marginal means

[b] Analysis of covariance

[c] Independent samples t-test

[d] Controlled for total energy intake

[e] Controlled for gender

Similarly, Table 4-15 presents the group WC differences between children who did or did not meet Milk Products, screen time and sleep recommendations. Children who met the Milk Products recommendation (p=.004) or the screen time recommendation had significantly lower WC values (p=.001). No significant WC differences were noted between children who met and did not meet the sleep recommendation.

Table 4-15: WC differences between children who did or did not meet Milk Products, screen time and sleep recommendations

	Met	*n*	WC (cm)	F	p-value[b]
Milk Products Recommendation	YES	15	94.9[a]	9.2	**.004**
	NO	30	104.3		
- Total Energy[c]	-	-	-	12.6	**.001**
- Gender[d]	-	-	-	17.7	**<.001**
Screen Time Recommendation	YES	11	92.2	13.1	**.001**
	NO	33	104.3		
- Gender[d]	-	-	-	23.8	**<.001**
Sleep Recommendation	YES	21	100.1	.460	.501
	NO	22	102.4		
- Gender[d]	-	-	-	20.5	**<.001**

[a] Estimated marginal means

[b] Analysis of covariance

[c] Controlled for total energy intake

[d] Controlled for gender

4.4.3 Relationship Between Child and Maternal Lifestyle Behaviours and Anthropometry

Maternal intake of Vegetables and Fruit were positively related to child intake of Vegetables and Fruit (r=.501, p=.011) and child total physical activity (r=.511, p=.013). Maternal intake of Milk Products and Others were also positively correlated with child intake of Milk Products (r=.527, p=.007) and Others (r=.408, p=.048), respectively. Inverse correlations were noted between maternal Grain Products and child's vigorous physical activity (r=-.425, p=.048) and video game time (r=-.619, p=.042). Maternal Meat and Alternatives intake were also negatively related to child intake of Milk Products (r=-.518, p=.008) and Others (r=-.434, p=.030). No other significant correlations were noted between child and maternal lifestyle behaviours and anthropometry.

Table 4-16 presents partial correlations among dietary lifestyle behaviours of mothers and children as well as the relationship between mother's steps and children's dietary behaviours. Results showed that maternal intake of Vegetables and Fruit, Milk Products and Meat and Alternatives were positively correlated with child intake of Vegetables and Fruit (r=.482, p=.023), Milk Products (r=.551, p=.006) and Meat and Alternatives (r=.523, p=.010), respectively. A significant, positive relationship was also noted between maternal steps and child's intake of Milk Products (r=.434, p=.030). A negative correlation was also observed between maternal intake of Others and child intake of Vegetables and Fruit (r=-.488, p=.010).

Table 4-17 presents similar correlation data between maternal and child lifestyle behaviours and anthropometry. When correlating mother's dietary behaviours and steps with child physical activity variables, a positive relationship was observed between maternal intake of Vegetables and Fruit and children's steps (r=.417, p=.043). In addition, a positive trend between maternal steps and child's total physical activity was also noted (r=.376, p=.070).

The relationships between mother's dietary behaviours and steps per day and children's sedentary lifestyle behaviours are presented in Table 4-18. Analyses revealed a negative, significant correlation between maternal intake of Meat and Alternatives and child television time (r=-.502, p=.012).

Table 4-16: Correlations between maternal dietary and step variables and child dietary variables

Mother[c] → Child[c] ↓	Grain Products[a] (servings/day)	Vegetables and Fruit[a] (servings/day)	Milk Products[a] (servings/day)	Meat and Alternatives[a] (servings/day)	Others[a] (servings/day)	Steps (steps/day)
Grain Products[a] (servings/day)	.183 (p=.402)	-.191 (p=.381)	-.289 (p=.181)	.011 (p=.961)	-.090 (p=.684)	-.155 (p=.458)
Vegetables and Fruit[ba] (servings/day)	.100 (p=.658)	.482 **(p=.023)**	.217 (p=.332)	-.066 (p=.772)	-.488 **(p=.021)**	.086 (p=.689)
Milk Products[a] (servings/day)	-.015 (p=.947)	.231 (p=.289)	.551 **(p=.006)**	-.433 (p=.039)	.003 (p=.990)	.434 **(p=.030)**
Meat and Alternatives[a] (servings/day)	.200 (p=.359)	-.110 (p=.618)	-.155 (p=.480)	.523 **(p=.010)**	-.218 (p=.319)	-.295 (p=.153)
Others[a] (servings/day)	-.216 (p=.322)	.141 (p=.522)	.010 (p=.963)	-.391 (p=.065)	.308 (p=.153)	.161 (p=.441)

[a] Controlled for total energy intake

[b] Controlled for gender

[c] $n = 50$ ($n = 25$ mothers, $n = 25$ children)

Table 4-17: Correlations between maternal dietary and step variables and child physical activity-related variables

Mother[b] → Child[d] ↓	Grain Products[a] (servings/day)	Vegetables and Fruit[a] (servings/day)	Milk Products[a] (servings/day)	Meat and Alternatives[a] (servings/day)	Others[a] (servings/day)	Steps (steps/day)
Total Physical Activity[c] (minutes/day)	-.099 (p=.670)	.248 (p=.278)	.178 (p=.441)	.019 (p=.936)	.075 (p=.746)	.376 (p=.070)
Vigorous Physical Activity[c] (minutes/day)	-.407 (p=.067)	.332 (p=.142)	-.001 (p=.998)	-.083 (p=.721)	.243 (p=.289)	.344 (p=.108)
Moderate Physical Activity[c] (minutes/day)	.133 (p=.564)	.023 (p=.921)	.269 (=.239)	-.034 (p=.885)	.078 (p=.735)	.231 (p=.277)
Steps[e] (steps/day)	.149 (p=.486)	.417 (p=.043)	.046 (p=.830)	.033 (p=.879)	-.009 (p=.965)	.337 (p=.092)

[a] Controlled for total energy intake

[b] Controlled for gender

[c] Data were log transformed prior to analyses

[d] *n* = 50 (*n* = 25 mothers, *n* = 25 children)

[e] n = 52 (n = 26 mothers, n = 26 children)

Table 4-18: Correlations between maternal dietary and step variables and child sedentary activity-related variables, BMI and WC

Mother^{b} → Child^{d} ↓	Grain Products^{a} (servings/day)	Vegetables and Fruit^{a} (servings/day)	Milk Products^{a} (servings/day)	Meat and Alternatives^{a} (servings/day)	Others^{a} (servings/day)	Steps (steps/day)
Total Screen Time^{b} (minutes/day)	-.007 (p=.975)	-.045 (p=.840)	-.044 (p=.843)	-.287 (p=.184)	.173 (p=.431)	-.312 (p=.129)
Television (minutes/day)	.268 (p=.205)	.003 (p=.989)	.099 (p=.647)	-.502 **(p=.012)**	.102 (p=.635)	-.028 (p=.892)
Video Game^{bc} (minutes/day)	-.486 (p=.185)	.249 (p=.517)	-.122 (p=.755)	.187 (p=.631)	.330 (p=.386)	.229 (p=.525)
Computer^{c} (minutes/day)	.268 (p=.267)	-.097 (p=.692)	-.260 (p=.282)	.102 (p=.678)	-.223 (p=.360)	-.385 (p=.085)
Total Sleep (hours/day)	-.083 (p=.705)	.219 (p=.315)	.225 (p=.302)	-.244 (p=.262)	-.198 (p=.364)	.243 (p=.241)
Child WC^{b} (cm)	-.024 (p=.912)	-.102 (p=.645)	-.286 (p=.187)	.148 (p=.500)	.094 (p=.668)	-.150 (p=.474)
Child BMI (kg/m^{2})	.078 (p=.717)	-.169 (p=.430)	-.366 (p=.079)	.213 (p=.317)	.042 (p=.846)	-.317 (p=.114)

[a] Controlled for total energy intake

[b] Controlled for gender

[c] Data were log transformed prior to analyse

[d] $n = 50$ ($n = 25$ mothers, $n = 25$ children)

Table 4-19 presents correlations among child lifestyle behaviours, BMI and WC with maternal BMI and WC. Negative correlations were revealed between mother's BMI and child's total physical activity (r=-.590, p<.001), vigorous physical activity (r=-.403, p=.020) and moderate physical activity (r=-.493, p=.002). Negative relationships were also seen between mother WC and child total physical activity (r=-.569, p<.001) and moderate physical activity (r=-.473, p=.003). Child television time was positively correlated with mother's BMI (r=.390, p=.013) and WC (r=.360, p=.022). Positive correlations were seen between child BMI and maternal BMI (r=.388, p=.013) and a positive trend was noted between child BMI and maternal WC (r=.312, p=.050). Significant correlations were not revealed between child WC and maternal BMI or WC.

Table 4-19: Correlations between various child lifestyle behaviours, BMI and WC and maternal BMI and WC

Variable	Mother BMI (kg/m^2)^d	Mother WC (cm)^d
Grain Products^a (servings/day)	.134 (p=.415)	.022 (p=.893)
Vegetables and Fruit^{ab} (servings/day)	-.228 (p=.169)	-.214 (p=.197)
Milk Products^a (servings/day)	-.170 (p=.302)	-.132 (p=.423)
Meat and Alternatives^a Products (servings/day)	.046 (p=.782)	.005 (p=.976)
Others^a (servings/day)	-.138 (p=.402)	-.016 (p=.924)
Total Physical Activity^c (minutes/day)	-.590 **(p<.001)**	-.569 **(p<.001)**
Vigorous Physical Activity^c (minutes/day)	-.403 **(p=.020)**	-.280 (p=.115)
Moderate Physical Activity^c (minutes/day)	-.493 **(p=.002)**	-.473 **(p=.003)**
Steps (steps/day)	-.130 (p=.423)	-.131 (p=.420)
Total Screen Time^b (minutes/day)	.241 (p=.139)	.217 (p=.185)
Television (minutes/day)	.390 **(p=.013)**	.360 **(p=.022)**
Video Game^{bc} (minutes/day)	-.465 (p=.060)	-.474 (p=.054)
Computer^c (minutes/day)	.147 (p=.416)	.111 (p=.540)
Total Sleep (hours/day)	-.151 (p=.359)	-.177 (p=.281)
Child BMI (kg/m^2)	.388 **(p=.013)**	.312 **(p=.050)**
Child WC^b	.270 (p=.096)	.276 (p=.089)

[a] Controlled for total energy intake

[b] Controlled for gender

[c] Data were log transformed prior to analyses

[d] *n* = 80 (*n* = 40 mothers, *n* = 40 children)

CHAPTER FIVE
DISCUSSION

The findings of this thesis provide a description of the population of children referred to the PCWH. This study revealed demographic and anthropometric characteristics as well as lifestyle behaviours of the overweight children and their parents/caregivers who attended the PCWH. Understanding children's food intake, physical activity levels, sedentary activity levels (screen time) and sleep habits are essential in determining the type of weight management programs and care required to assist boys and girls in adopting and maintaining healthy behaviours to manage their weight.

5.1 MAJOR FINDINGS

Several findings have arisen from this research. The major finding of this project, similar to previous research conducted on children in the United States and Canada, was that overweight children were not meeting healthy lifestyle behaviour recommendations. The second major finding was that children's intake of Milk Products were inversely correlated with child BMI and WC. In addition, children who did not meet the Milk Products recommendation were found to have greater BMI and WC than children who did meet the recommendation. Similarly, the third major finding was that child consumption of Grain Products was positively associated with child BMI. The fourth major finding was that children's physical activity and screen time were negatively correlated. The fifth major finding was that children who met the screen time recommendation had smaller WC and BMI compared to children who did not meet the recommendation. The final major finding of this research study was that maternal anthropometry and lifestyle behaviours were related to and potentially influenced child BMI and intake of Vegetables and Fruit, Milk Products and Meat and Alternatives. Overall, these results suggest that the population of overweight 8 to 17 year old children referred to the PCWH for weight management are not achieving lifestyle behaviour recommendations and that maternal lifestyle behaviours may exert an important influence on the behaviours of their children.

5.2 GENERAL DISCUSSION

The general discussion will address the following research questions:

1. *What are the demographic and anthropometric characteristics and lifestyle behaviours of overweight 8 to 17 year old children referred to the PCWH for weight management and their parents/caregivers?*

2. *What are the relationships among lifestyle behaviours and/or anthropometry of 8 to 17 year old children referred to the PCWH for weight management?*

3. *What are the relationships between lifestyle behaviours and anthropometry of 8 to 17 year old children referred to the PCWH for weight management and their parents/caregivers?*

The relationships among lifestyle behaviours and anthropometry are difficult to separate from the actual demographic, anthropometric and lifestyle behaviour data; therefore, sections 5.2.1 and 5.2.2 will address research questions 1 and 2 while section 5.2.3 will address question 3.

5.2.1 Participant Characteristics

Children in this study were extremely homogeneous. All children had an age- and sex- specific BMI ≥85th percentile based on the CDC growth charts, indicating that all children involved in this study were either at-risk of overweight or overweight (Kuczmarski et al., 2000). In addition, 43 children (96%; *n* = 45) had an age- and sex- specific WC ≥85th percentile based on NHANES III data (National Center for Health Statistics, 1998). This is disconcerting as children with increased body weight are not only at increased risk of adult obesity

(Freedman et al., 2005; Freedman et al., 2004; Dietz & Gortmaker, 2001; Guo et al.,1999; Whitaker et al., 1997), but also at increased risk of developing adult-related health consequences such as dyslipidemia, elevated insulin levels, hypertension and type 2 diabetes (Fagot-Campagna et al., 2000; Rosenbloom et al., 1999; Freedman et al., 1999; Morrison et al., 1999). Males were significantly heavier than females and had higher BMI percentiles and WC values. This is not surprising as males are generally larger than females. Differences in male and female height, BMI and age were not significant. This is likely due to the varied age and growth rates of children. The study population was primarily Caucasian (80%; *n* = 45) which, based on Statistics Canada, is representative of Edmonton, AB (~81% Caucasian) (Statistics Canada, 2001). The majority of child participants (62.2%; *n* = 45) came from families of married or common law parents. A third of the children came from separated or divorced parent families (31.3%; *n* = 45). Ethnicity and family dynamics are important to consider when developing programs to meet the needs of PCWH specific children. Programs must be relevant to the lives of children and their families, for example, providing various ethnic groups with appropriate dietary education including their traditional foods or providing child care for single parent families.

Analyses revealed that, on average, mothers were younger, shorter and weighed less than fathers while fathers, likely due to their larger stature, had higher mean WC compared to mothers. The mean BMI for both mothers (34.7 ± 9.7) and fathers (32.7 ± 7.7) fell within Obese Class I (30.0-34.9) based on the adult Canadian guidelines for body weight classification (Health Canada, 2003). In addition, the mean WC of both mothers (99.7 ± 18.6) and fathers (107.8 ± 18.2) exceeded the "normal" recommendations of 88cm and 102cm, respectively. This indicates that the mothers and fathers in our study are at a very high risk of developing health problems (Health Canada, 2003). Results also revealed that the majority of mothers (72.2%; *n* = 36) and fathers (data available on 10) had completed some post secondary education. Again, this is important information to consider when establishing treatment strategies for overweight children and their parents/caregivers. Knowing that the parents/caregivers are also at increase risk of health problems imply that weight management treatment strategies developed for the PCWH children may need to focus on improving the health of the entire family and not only the children. Education level of parents/caregivers will also help determine the level of education and literacy required at the PCWH. Socioeconomic levels of participant families were unavailable due to discrepancies with family income and number of people in the household. However, it would be worthwhile for future research to evaluate socioeconomic levels and its effect on child and parent/caregiver weight status.

The parent/caregiver sample was limited in the amount of demographic, anthropometric and lifestyle behaviour information available on fathers. Therefore, maternal data will be used when focusing on parent/caregiver findings throughout this discussion.

5.2.2 Lifestyle Behaviours

5.2.2.1 Food Intake

Assessment of food intake in the present study revealed significant gender differences between servings of Vegetables and Fruit and total energy. Overall, 71% of children did not meet the Vegetables and Fruit intake recommendation and 67% did not meet the Milk Products recommendation. Ninety-six percent of children achieved the Grain Products recommendation and nearly half of children met the Meat and Alternatives recommendation. Intake of food in the Others category was high with average approximate intakes of 24 servings for females and 37 servings for males. These findings indicate that PCWH children have poor eating habits, specifically intake of Vegetables and Fruit, Milk Products and Others.

In comparison to other research studies that examined CFGHE recommendations of children and youth, our research study had similar findings. The National 2004 CCHS: Nutrition (Garriguet, 2006) revealed that children and adolescents (2 to 17 years of age) consumed an average of 4.5 servings of Vegetables and Fruit per day, which is comparable to the mean servings found in our sample of overweight children. The same survey found that 37% of children 4 to 9 years of age and 61% (boys) and 83% (girls) children 10 to 16 years of age did not meet their minimum CFGHE recommendation of Milk Products per day. The CCHS: Nutrition (2004) also received similarly high intakes of Other Foods compared to our study. According to the survey, Other Foods accounted for 22.0% of the total calories consumed by Canadians, which increased to 25.0% for adolescents aged 14 to 18 years of age. We were unable to determine how many calories from the Others category accounted for total energy intake; it is assumed that 29 servings per day (on average) exceeds the CFGHE recommendation of moderate daily intake. Overall, PCWH children are not meeting CFGHE recommendations. Many other Canadian studies (Action Schools! BC, 2005; Veugelers et al., 2005; Veugelers & Fitzgerald, 2005; Jacobs-Starkey et al., 2001) and local data (Ball et al., 2005) have identified similar findings demonstrating poor eating habits of Canadian children. This is of concern since inadequate intakes of Milk Products and Vegetables and Fruit (to a lesser degree) were associated with increased WC and/or BMI in our study. Of greater and future concern are the increased adverse health effects, such as cardiovascular disease, type 2 diabetes, elevated blood pressure, insulin resistance, and the metabolic syndrome that have been linked to increased WC and BMI in adults (Janssen et al, 2002; Styne, 2001; WHO, 2000) and WC in children (Hirschler et al., 2005; Katzmarzyk, 2004; Maffeis et al., 2003; Moreno et al., 2002; Maffeis et al., 2001a; Maffeis et al., 2001b).

Our analyses indicated significant, negative relationships between child BMI and Milk Products as well as child WC and Milk Products. Children who did not meet CFGHE serving recommendations for Milk Products also had greater BMI and WC than children who met Milk Products recommendations. In addition, children who consumed inadequate servings of Vegetables and Fruit had a slightly (but non-significant) higher BMI. These findings are consistent with the literature that also suggests a link between risk of childhood overweight and obesity and inadequate consumption of milk products, vegetables and fruits (Shields, 2005; Weaver & Boushey, 2003).

The consumption of calcium and dairy products are associated with lower body fat in children (Weaver & Boushey, 2003). Research by Skinner and colleagues (2003) and Carruth & Skinner (2001) collected dietary and growth data on 53 white children from 24 to 70 months of age. Three-day dietary intake records and measured heights and weights were collected using in-home interviews at 6 month intervals and dual energy X-ray absorptiometry (DEXA) was used to assess body composition of children at 70 months of age. Results of their studies found that dietary calcium was inversely related to body fat in children 5 to 8 years of age. Skinner et al. (2003) explained how this negative relationship between body fat and calcium could reduce children's body fat by 0.4% if children increased their calcium intake with one cup of milk or yogurt per day. Although this percentage does not seem remarkable, a slight decrease in body fat may reduce the risk of overweight or obesity from a weight maintenance or obesity prevention standpoint. Also, we must consider that at the population level, a 0.4% decrease in body fat is substantial. Consequently, encouraging children to increase daily servings of low fat Milk Products as a means of increasing calcium intake may help to prevent excess weight gain and prevent childhood overweight. In addition, milk intake habits established in childhood contribute to similar milk intake in adolescents and adulthood (Teegarden et al., 1999). Therefore, if children make a habit of consuming low fat Milk Products early in life, they are more likely to acquire the long-term benefits of calcium and will be more likely to maintain an adequate intake of Milk Products into adulthood.

Furthermore, according to the 2004 CCHS data, Canadian children (2 to 17 years of age) who consumed vegetables and fruits 5 or more times a day were substantially less likely to be overweight or obese than those who consumed vegetables and fruits less than 5 times a day (Shields, 2005; Stats Canada, 2004). Plausible explanations for this could simply be that vegetables and fruits are high in nutrients, low in calories and are a great source of fibre. This allows one to eat a larger quantity of food, but receive fewer calories. Fibre has also been known to make one feel fuller for longer, possibly decreasing intake (Delzenne & Cani, 2005; Gerstein et al., 2004). There is also evidence that increased consumption of vegetables and fruits may result in reduced intakes of high fat/high calorie foods by displacement (Robinson, 1999). In addition, research on food preferences has found that increased exposure to tastes (for example, vegetables and fruits) increases one's preference for those tastes (Birch, 1992). It is also important to note that there are many other health benefits of increased intake of vegetables and fruits related to chronic disease prevention. Vegetable and fruit consumption has been linked with a decreased incidence of cardiovascular disease, stroke, type 2 diabetes, hypertension and some cancers (Bazzano, 2006), which are all adiposity-related health risks. Therefore, encouraging overweight children to increase their consumption of vegetables and fruits may be a worthwhile strategy to help children manage their weight as well as improve overall dietary quality and possible adiposity-related health risks.

Results of our study also revealed a significant, positive correlation between child intake of Grain Products and BMI. This finding is intriguing as the Grain Products recommendation was the only lifestyle behaviour met by almost every child in our sample (96%). Possible explanations for satisfying this recommendation could relate to the increased serving sizes of store bought Grain Products, such as muffins and bagels, or increased intakes of high-calorie baked goods. Many Grain Products, such as pasta and rice, are often consumed in large portions and topped with cream sauce, cheese, butter or margarine. The simplicity of preparing Grain Products may also be linked to this positive correlation.

Study outcomes did not reveal any associations between children's consumption of Others and BMI or WC. This is somewhat surprising as children did consume, on average, 29 servings of Others daily which, although CFGHE does not have a specific recommendation, this number far exceeds the general "in moderation" CFGHE suggestion. However, the Others category calculated in the diet analysis software program (Food Processor) includes intrinsic fats as well as fats, sugars, sweets and oils, and does not correspond exactly with the description of the Other Foods category in CFGHE. Therefore, when comparing to CFGHE, the servings of Others may be overestimated in this study. Nevertheless, in the survey by Garriguet's (2006), as well as in our study, many of the foods included in the Others category were comprised of low nutrient dense, high calorie and high sugar/fat foods such as soft drinks, fruit drinks, oils, butter, margarine, potato chips and chocolate bars. Thus, assuming that these children will continue to consume high intakes of Other Foods, we cannot ignore the link that exists between increased consumption of low nutrient dense, high calorie foods and overweight and obesity (Swinburn and Egger; 2002). Future research to analyze this relationship would benefit from a Canadian diet analysis program that determines exactly how many Other Foods the PCWH children are consuming.

In summary, overweight children referred to the PCWH are not meeting CFGHE recommendations for Vegetables and Fruit and Milk Products. The cause for these poor eating habits cannot be determined from this study. However, we can speculate that children's physical and family environments play a large role in eating habits established. Poor eating habits learned at a young age may be responsible for initiating the increased body weight of these children. The abundance of unhealthy, energy dense foods available in today's homes, schools and communities make it very difficult for children to choose healthy foods and healthy amounts of food.

5.2.2.2 Physical Activity (Quality/Quantity) & Screen Time

Assessment of the quality and quantity of child physical activity levels in this study revealed no significant differences between genders. Overall, mean total physical activity, vigorous physical activity and moderate physical activity for females and males fell below the CPAGCY recommendations (Health Canada, 2002). In fact, only 11% of children in the study were moderately active or vigorously active for ≥90 minutes each day. Gender differences showed that 23% of males and only 7% of females met the Canadian physical activity recommendation. This is not surprising as gender gaps have been noted in the literature revealing that girls consistently report less absolute daily physical activity than boys, which may help to explain why fewer girls are meeting physical activity recommendations (Healthy Active Kids Canada, 2006).

Average steps per day for girls and boys were below the recommended step goals of 12,000 steps per day for girls and 15,000 steps per day for boys (Tudor-Locke et al, 2004). Only 2% of females met the step recommendations while no males met the recommendations. This is important to note as the pedometer-derived cut point step recommendations were developed based on research from normal weight and overweight children. Tudor-Locke et al. (2004) found that girls taking < 12,000 steps per day and boys taking < 15,000 steps per day were more likely to be overweight. At this time, there is not enough evidence to determine if these recommended step goals improve health outcomes of overweight children; however, the fact that the majority of overweight children in our study did not achieve the step recommendations is a concern. In addition, mean mother and father steps were below the 10,000 steps per day recommendation for adults (Tudor-Locke & Bassett, 2004; Kosta, 2001) with only 24% of parents/caregivers meeting the recommendation. The adult step goal has been reported as a reasonable estimate of physical activity for healthy adults and has received published documentation of health benefits (Tudor-Locke & Bassett, 2004; Swartz & Thompson, 2002; Moreau et al., 2001). Regardless, findings from our study are consistent with the Canadian literature indicating that children are not engaging in enough physical activity to support health (Healthy Active Kids Canada, 2006; Healthy Active Kids Canada, 2005; Shields, 2005; Federal, Provincial and Territorial Advisory Committee on Population Health, 1999). This is a concern as regular physical activity provides many health benefits, such as weight control, stress reduction, building strong bones and reducing the risk of risk of type 2 diabetes, heart disease, depression and some types of cancer (Marcus et al., 2006; Federal, Provincial and Territorial Advisory Committee on Population Health, 1999).

Results from our assessment of children's sedentary behaviours, (specifically screen time) are consistent with other research on overweight children. Approximately 76% of children exceeded the maximum recommendation of no more than 90 minutes of screen time per day; only 20% of boys and 28% of girls met this recommendation. High levels of screen time are a concern, especially since this sample of overweight children are very limited in the amount of physical activity they are achieving. Research by Hughes and associates (2006) compared habitual physical activity and sedentary behaviours of 53 obese children to 53 non-obese child controls (6.6 to 10.6 year old). Their study found that, over a 7-day period, obese children spent an average of 80.9% of time in sedentary activity and 2.4% of time in moderate-to-vigorous physical activity (MVPA) compared to non-obese controls that spent 79.3% of time in sedentary activity and 3.9% of time in MVPA. Researchers concluded that the difference in MVPA, total physical activity and sedentary behaviours between obese and non-obese children was relatively small and not exceptionally different. Thus, obese children demonstrate very low physical activity levels but, all children, regardless of weight, are spending increased time in front of a screen (Hughes et al., 2006).

Possible reasons for the inadequate levels of physical activity and the increased screen time in our population of overweight children could be due to their weight status. Overweight children may fear participating in organized or non-organized sports because of teasing or other victimization from their peers or simply because they feel less fit or less athletic (Must &Tybor, 2005; Janssen et al., 2004; Johnson et al., 2000). Physical limitations from excess weight may also limit physical activity or increase screen time in overweight children. Understanding the role that sedentary behaviours play in the etiology of overweight is not that well developed at this time, however, it has been suggested that being overweight may make it more difficult to exercise due to physical limitation, social isolation or having fewer friends (Must & Tybor, 2005; Strauss & Pollack, 2003). Finally, physical activity and sedentary behaviours, like all lifestyle behaviours, are influenced by children's role models. Decisions to be physically active or sedentary are influenced by the skills, values, knowledge, confidence, support, transportation and role modeling provided by parents/caregivers (Healthy Active Kids Canada, 2006; Trost et al., 2005; DiLorenzo et al., 1998).

Significant gender differences were noted between sedentary activities. The average total screen time was higher for males than females. Males spent much more time playing video games than females thereby increasing the total screen time for males. Our study also revealed significant, inverse correlations of total screen time and television time with total physical activity, moderate physical activity and steps. These inverse relationships imply that as screen time increases, physical activity decreases (or vice versa). Comparable correlations between television time and physical activity have also been reported by Andersen and colleagues (1998) and Janssen and colleagues (2005). Consequently, our results support that increasing physical activity and decreasing screen time are critical and worthwhile components of the treatment and prevention of childhood obesity (Goldfield et al. 2006). In our population of children, successful strategies developed to modify children's physical activity and screen time must consider and reflect gender differences in screen time preferences. For example, we know that males spend significantly more time playing video games than females; therefore, interventions should reflect this gender difference by emphasizing the reduction of video game time, rather than total screen time, for males. Furthermore, we found that children who did not meet the screen time recommendations had significantly higher WC and BMI compared to children who did meet the recommendations. This provides further support for the weight management strategy of encouraging overweight children to decrease time spent in front of a screen.

Negative associations were revealed between intake of Milk Products and total screen time and Milk Products and computer time. A positive relationship was also seen between computer time and intake of Meat and Alternatives. The Milk Products and screen time relationship is not well understood, but could possibly be linked to food displacement. Children who spend time in front of a screen may displace Milk Products with other types of foods or beverages. Or it may be that children who are consuming more Milk Products are more concerned about health and therefore make healthier food choices and choose to spend less time in front of a screen. Preferences could also be a plausible explanation for the relationships between screen time and Milk Products and screen time and Meat and Alternatives. Nonetheless, more research is needed to further understand these relationships.

There were no correlations between intake of Others and screen time. This came as a surprise as children's mean intake of Others was quite high and relationships between screen time and obesity-promoting dietary intakes (such as high-energy beverages and sweet and savoury snacks) have been previously reported in children (Campbell et al., 2006; Giammattei et al., 2003; Boynton-Jarrett et al., 2003). Contributing to the insignificant findings may be the small child sample size or the fact that the Others category does not only refer to food, but also includes the intrinsic fats and sugars in food. Research that reports positive correlations between screen time specifically, television time and the consumption of Other foods has suggested that it may be linked to the exposure of food advertising on television, preference for and/or increased intake of advertised foods; it may be that spending time in front of a screen creates an environment that encourages frequent snacking (Campbell et al., 2006; Francis et al., 2003; Borzekowski & Robinson, 2001; Robinson, 2001). Findings from a number of US studies have found that television viewing increases energy intake by either eating during viewing or by increasing energy consumption of highly advertised foods (Vereecken et al., 2006; Matheson et al., 2004; Crespo et al., 2001; Coon et al., 2001; Robinson, 2001; Robinson, 1999). Regardless of our findings to date, ongoing monitoring of the relationships between screen time and intake of Other Foods seems essential. Also, supporting children and parents to limit Other Foods or find alternates to screen time may be an appropriate weight management strategy (Campbell et al., 2006).

To summarize, children are not meeting qualitative or quantitative physical activity recommendations, nor are they satisfying the maximum 90 minute per day recommendation for screen time. Additional research will need to be conducted to compare different strategies focusing on either reduced screen time or increased levels of physical activity and the influence these changes have on the lifestyle behaviours and adiposity of overweight children.

5.2.2.3 Sleep

Child sleep patterns revealed that approximately 50% of children 9 to 11.9 years of age and 48% of children 12-17 years of age are obtaining adequate hours of sleep based on recommendations. This is a concern as research has demonstrated an inverse relationship between obesity and short sleep duration (Loeard et al., 1992). More resent research has also found that reduced amounts of sleep are associated with overweight and obesity in children and adults in urban and rural settings (Kohatsu et al., 2006; Chaput et al., 2006; Vorona et al., 2005; Gupta et al., 2002). Our study revealed that not only are 50% of children not meeting sleep recommendations, but an inverse relationship between hours of sleep and WC and BMI also exists. This relationship between weight status and sleep duration is thought to be due to a fluctuation in leptin and ghrelin (appetite regulatory hormones) (Spiegel et al., 2004; Taheri et al., 2004). However, this relationship may also be related to the energy level of children. Children who receive less sleep may participate in less physical activity because they are too tired, possibly increasing their WC or BMI. When the relationship between sleep duration and WC and BMI was further analyzed to determine if meeting or not meeting the sleep recommendations made a difference in WC or BMI, results were not statistically significant. However, considering the small sample size of children involved in the study, there may not have been adequate power to detect a difference. Thus, more research is required to verify the relationship among sleep duration, weight status, physical activity, energy levels and appetite hormones in overweight children.

Regardless of the relationship between sleep duration and weight status, similar to nutrition and physical activity, sleep is a very important indicator of health. Sufficient sleep quantity and quality are important components of a healthy lifestyle that should be assessed and targeted when addressing the overall health of children and youth (Zee & Turek, 2006).

5.2.3 Association of Maternal Anthropometry and Lifestyle Behaviours on Children's Anthropometry and Lifestyle Behaviours

Results indicted that maternal BMI was negatively correlated to child's total physical activity, vigorous physical activity and moderate physical activity. Similarly, maternal WC was also negatively correlated with child total physical activity and moderate physical activity. This implies that children who have mothers with higher BMI or WC are less physically activity, or as maternal BMI or WC decreases, children are more physically active. An explanation for this relationship could be that mothers with lower BMI and WC may actually be more active and possibly increase the physical activity levels of children through role modeling. It has been noted in the literature that parent exercise and physical activity are positively associated with child physical activity (Moore et al., 1991) and specifically extracurricular sport involvement (Clenland et al., 2005).

Positive correlations were seen between mother BMI and child television viewing as well as mother BMI and child BMI. Similarly, maternal WC was associated positively with child television viewing and BMI. Logically, mothers who have higher BMI or WC may in fact spend more time in sedentary activities and therefore could influence children's sedentary activity levels. These correlations highlight the important link between maternal anthropometry and their influence on child BMI and screen time habits. Interestingly, consistent findings have been reported by Vendewater & Huang (2006) stating that parental weight status is an important moderator of the relationship between child weight status and television viewing. In our research study, we did not collect data on the screen time habits of mothers. However, in the future, it may be worthwhile to collect sedentary lifestyle information from parents/caregivers and children to help explain the link with sedentary activity behaviours and weight status.

Mother's food intake was significantly correlated with child food intake for Vegetables and Fruit, Milk Products and Meat and Alternatives. These findings are consistent with the literature (Fisher & Mitchell, 2002), may reflect the availability and accessibility of food in the home environment and highlight the mother's important role of modeling healthy eating habits. Research has revealed that children model parent eating behaviours and are influenced by parental food practices (Fisher & Mitchell, 2002; Birch & Davison, 2001; Fisher & Birch, 1995). For example, parents concerned that their children are overweight often practice controlling and restrictive feeding styles that teach children to ignore their internal cues of hunger and satiety (Spruijt-Metz et al., 2002). This is a concern as these controlling and restrictive feeding practices have been shown to decrease children's ability to regulate energy intake resulting in higher BMI and positive energy balance (Birch & Davison, 2001; Birch & Fisher, 2000; Fisher & Birch, 1999; Johnson & Birch, 1994). Controlling parental food practices have also been shown to have a negative relationship with children's intake of vegetables and fruit and a positive relationship with fat intake (Fisher & Mitchell, 2002). Ideally parental food practices that are sensitive and responsive to the feeding cues of children are encouraged. The division of responsibility model suggests that it is the parents responsibility to provide children with healthy food choices and a supportive eating environment while it is the child's responsibility to decide what to eat and how much (Satter, 1996). This "trust" paradigm allows children to tap into their internal feeding cues of hunger and satiety, while giving the child more control over their eating habits (Golan & Crow, 2004; Satter, 1996). Parents also play a very important role in the modeling of behaviours. Research on parents and their children have revealed that parents who consume more vegetables and fruits have daughters who consume more vegetables and fruits

(Fisher & Mitchell, 2002); whilst some studies have also noticed similarities in food preferences among children and their parents (Vauthier et al., 1996; Patterson et al., 1988; Billon et al., 2002).

We also noted a significant, inverse relationship between child's Vegetables and Fruit consumption and mother's intake of Others. This negative relationship is interesting as it could provide some insight into the home environment and the important part that mothers play as role models. Plausible explanations could possibly be due to the limited availability of vegetables and fruits in the home, the preference for low nutrient, high fat/sugar foods or the fact that mothers and children are filling up on Others and therefore displacing vegetable and fruit intake. Additional research would need to be conducted to actually understand the cause and effect relationship that exists between these two variables.

To conclude, parents provide children's contextual environment making them vital players in the prevention and treatment of childhood overweight. Based on our data, as well as previous research, parental weight status and behaviours may influence children in countless ways. Therefore, including both children and parents/caregivers in weight management initiatives is crucial to improving and maintaining the health of overweight children and their families.

5.3 STRENGTHS AND LIMITATIONS OF THE STUDY

5.3.1 Strengths

This study had several strengths. All children who were referred and attended the PCWH and their parents/caregivers were included in the study. Although the total sample size was small, the participants studied represented the total population of children and parents/caregivers attending the PCWH. The PCWH is a research-based, weight management centre that provides long-term follow-up; therefore, longitudinal data on all study participants could potentially be collected. The multi-disciplinary nature of the PCWH also provided study strength. Each health professional was available to perform the study measures within their expertise. For example, all 4-day food records were explained and review by the PCWH registered dietitian while all physical activity measures were addressed by the exercise specialist. In addition, all 4-day food records were entered into the dietary software program by the registered dietitian. This increased reliability and consistency of participant data. The inclusion of anthropometric data as well as dietary, physical activity, screen time and sleep assessments also provided the opportunity to study the relationships between the many lifestyle behaviours that effect health and how they related to childhood overweight. Assessment of parent/caregiver data is another important feature of the study. Including parents/caregivers in our population allowed us to analyze the relationships between child and parent/caregiver anthropometry and lifestyle behaviours.

5.3.2 Limitations

The present study included a homogeneous sample of overweight children who were selected on the basis of having been referred to the PCWH for weight management. Therefore, variability was limited as all children were above the 85th percentile for BMI-for-age and sex (Kuczmarski et al., 2000) and 96% were above the 85th percentile for WC (National Center for Health Statistics, 1998). The specific aim of this study was to describe and understand the population of children referred to the PCWH rather than the general population of overweight children. Consequently, the extent to which the observed results can be generalized to the general population of overweight children is uncertain. The sample size limited our ability to examine associations among different child age and sex groups. As well, the small sample size limited our ability to perform some statistical analyses with appropriate power (e.g., paternal lifestyle behaviour data). In addition, since the study was a cross-sectional design, assumptions as to causality cannot be made. Instead, only associations between anthropometry and behaviours can be reported.

A methodological limitation of the study was the inability of the diet analysis software program to determine the number of servings from CFGHE. Instead, only Food Pyramid (American) servings were calculated. Computer generated calculations of CFGHE servings may have provided more accurate servings from the Vegetables and Fruit and Milk Products food groups, as each had to be manually adjusted. Other limitations of the diet analysis software program included the addition of potato chips, French fries and hash browns to servings of the Vegetable food group. These had to also be manually adjusted and removed as to not misrepresent the CFGHE servings of Vegetables and Fruit.

Although including parent/caregiver anthropometric and lifestyle behaviour information in our study provides some strength, we had a very small sample of father participants. Finally, self-report data were completed by child and parents/caregivers for food intake and steps while children also self-reported levels of physical activity, screen time and sleep. Therefore, similar to previous research, it is possible that some children or parents/caregivers may have over or under-reported lifestyle behaviours (Fisher et al., 2000; Welk et al., 2000; Buchowski et al., 1999; Klesges et al., 1995; Bandini et al., 1990).

CHAPTER SIX
CONCLUSIONS

6.1 CONCLUSIONS

Childhood overweight is a serious issue and has increased dramatically in Canada in recent years. Data from the 2004 CCHS revealed that 18% of Canadian children aged 2-17 years of age were overweight and 8% were obese (Shields, 2005). Furthermore, local data estimates that approximately 25.0% of children in the urban Edmonton-area are overweight (Ball et al., 2001). In response to these high rates of childhood overweight and obesity, the new PCWH has been established at the Stollery Children's Hospital in the Capital Health region (Edmonton, AB). The PCWH is a research based treatment centre for overweight children and their families. The mission of the PCWH is to provide leadership in pediatric weight management care, and to develop and share expertise to promote healthier lifestyles for overweight children and their families. At the present time, the PCWH is delivering and evaluating several evidence-based interventions and monitoring child health and behaviour outcomes to help determine the best possible treatment and care for overweight children. Findings from this thesis provides the PCWH with valuable information on the population of children referred for weight management and can be used to support existing programs and develop future programs.

Results of the present research study have provided evidence that overweight children being referred to the PCWH are not practicing healthy lifestyle behaviours. Overall, this population of overweight children has displayed unhealthy eating habits, low levels of physical activity, high amounts of screen time and shorter than recommended sleep durations. As described throughout this thesis, lifestyle behaviours play a very important role in the overall health of children and youth, including a healthy body weight. It has also become evident from this study that mother's play a vital role in the health of children. Thus, it is imperative that health professionals emphasize intervention strategies that meet the needs of PCWH children, addressing improvements in lifestyle behaviours of both children and parents/caregivers.

6.2 FUTURE RECOMMENDATIONS

The following future recommendations are based on the results of this research study and supporting literature:

6.2.1 Recommendations for PCWH

1. Evidence-Based Weight Management Intervention Strategies:
    - Involve and treat the entire family, especially children and their parents/caregivers.
    - Encourage Ellyn Satter's 'Division of Responsibility' feeding relationship.
    - Encourage increased consumption of vegetables, fruits and milk products.
    - Encourage limited intake of Other Foods (based on CFGHE).
    - Provide education on choosing healthy Grain Products (high fibre, low fat, etc.).
    - Encourage increased physical activity.
    - Encourage decreased screen time.
    - Encourage decreased videogame time for boys.

2. Future Research Recommendations:
    - Increase sample size to increase power of the findings.
    - Evaluate socioeconomic levels and its effect on child and parent/caregiver weight status.
    - Evaluate interventions and programs currently being offered at the PCWH to determine if they are meeting the needs of the PCWH population.
    - Continue to collect demographic, anthropometric and lifestyle behaviour data of children to evaluate the effect of interventions and trends over time.
    - Continue to collect demographic, anthropometric and lifestyle behaviour data of parents and caregivers to help with further examination of the factors related to child weight status.

- Collect child and parent/caregiver feeding and snacking behaviours during screen time.
- Conduct research specifically related to sleep duration to help understand mechanisms and links between sleep and overall health as well as total energy, physical activity, food intake, parent work hours, income, single parent families and possibly appetite hormones.
- Record sedentary behaviours (sleep and screen time) and physical activity behaviours (total, vigorous and moderate physical activity) of parents and caregivers to help identify the possible relationships and influences on children.
- Determine and examine the determinants of childhood overweight (physical/social environment) in the population of PCWH children.

6.2.2 Final Comment

While the treatment of childhood overweight is a serious issue and must be addressed, it is also imperative that efforts are put in place to prevent this devastating childhood disease at a population level. Thus, as researchers and health professionals, we must advocate for population wide health promotion obesity prevention strategies. We must work together to make changes to our ever increasing obesogenic environment and make the healthiest choices the easiest choices.

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APPENDIX A: Information Sheets and Consent Forms

Information Sheet

Title of the Project: **The HIP (Healthy Initiatives Program) Study**

Dr. Geoff DC Ball, PhD, RD	**Julie Lenk, RD, MSc Candidate**
Principal Investigator,	Project Coordinator,
Phone: 780-407-3784	Phone: 780-492-8837

Please ask for an explanation of any words or information contained in this Information Sheet that you do not clearly understand. If you have questions during the study, you are free to ask them at any time.

Purpose of the Study

The purpose of this research study is to study 3 different weight management programs for improving the health of overweight adolescents (13 – 17 years old) with a family history of type 2 diabetes. The results of this study will be used for a graduate student thesis. The results will also help to develop weight management programs for the Pediatric Centre for Weight and Health (PCWH).

Background

Rates of overweight among boys and girls have increased in Canada over the past several years. These increases are thought to be linked to changes in nutrition and physical activity levels. Overweight boys and girls are at an increased risk of health problems and diseases, such as type 2 diabetes and heart disease. At the present time, we know very little about what types of programs help overweight children and adolescents improve their health. In this study, we will study different programs that may help overweight boys and girls become healthier.

Procedures

Once we receive your returned consent form, your child will also be asked to consent to participate. Then, as a family you will take part in the Screening Visit.

Baseline 1 (~3 hours long):

The screening visit will take place at the PCWH in the Stollery Children's Hospital and will include the following:

Physical Exam: The study pediatrician (Dr. Casey) or PCWH nurse will conduct a medical history and physical exam. The pediatrician or nurse will also meet with you and any other primary parent/guardian to get information on ethnicity, family history of type 2 diabetes and heart disease as well as socioeconomic status. Height and weight will also be measured in both you and your child.

Psychiatrist Interview: Your family will be interviewed briefly by the study psychiatrist (Dr. Carolyn Steinberg) to ensure that the study is appropriate for your child.

Questionnaires: Your child will be asked to complete 4 questionnaires. You will be asked to complete 2 questionnaires. The questionnaires include questions about school, work, behaviour, social environment, physical activity, body image, peer and family relationships.

Hip and Waist Measurements: The research staff will measure your child's waist and hip circumferences using a tape measure. This measurement will be made in the PCWH.

Blood Pressure: Your child's blood pressure will be measured using an automated monitor. This procedure will require your child to sit quietly. The total test will take about 15 minutes.

Physical Activity – Pedometer: Your child will measure his/her walking behaviour. A pedometer will be used to measure the number of steps your child takes over a 4 day period. A pedometer is a small device that is attached at the waist and measures the number of steps taken per day. Your child will receive a pedometer and will be shown by a member of our research staff how to use it. Your child will be given a booklet to record the number of steps taken per day.

Food Record: The PCWH dietitian will teach you and your child how to complete accurate food records. Your child will then be asked to record their food intake for 4 days. This will occur at the same time he/she is wearing the pedometer.

Baseline 2 (~1.5 hours; 7 – 10 days after day 1):):

This visit will take place about 1 week after the Screening Visit (Baseline 1). All of the following measurements will be made at the PCWH or the University of Alberta and will include the following:

Physical Activity – Pedometer and Food Record: Your child will return the pedometer log book and food record at this time, and review it with the exercise specialist and the dietitian.

Physical Activity Questionnaire: Your child will be asked to complete a questionnaire with the exercise specialist to measure how active they were over the last 7 days.

Grip Strength Fitness Assessment: Your child will squeeze a hand grip dynamometer to measure upper body strength in each arm. Three trials will be performed. The highest score will be recorded.

Bioelectrical Impedance Assessment (BIA): Your child will be asked to take their shoes and socks off and stand on the BIA machine. This test only takes about 30 seconds and measures the amount of fat and fat-free mass in your child's body.

Aerobic Fitness Assessment: Your child will complete a walking fitness test using a treadmill to measure their aerobic fitness. Resting heart rate and blood pressure will be measured prior to the test. Your child will then perform a 5 minute warm up and familiarization on the treadmill. During the test, heart rate and perceived exertion will be monitored every 1 minute. Your child's blood pressure and respiratory gases may be monitored and collected during the test. Heart rate and blood pressure will be monitored and recorded at 1 minute and 5 minutes after exercise.

Baseline 3 (~2.5 hours):

You and your child will be accompanied by the project coordinator (Julie Lenk) to the following tests completed at Baseline visits 3 and 4.

Fasting Blood Sample and Oral Glucose Tolerance Test: The fasting blood sample and oral glucose tolerance test (OGTT) will be performed by an experienced registered nurse. Your child will complete an OGTT to find out if they have type 2 diabetes. First, a fasting blood sample will be taken from your child. Then we will ask him/her to drink a small glass of a 'sugar-like' drink (it tastes like flat 7-Up pop). Then, 6 blood samples will be taken over the next 2 hours.

Baseline 4 (~2.5 hours):

Body Composition: Your child's total bone density, muscle mass and fat mass will be measured using dual-energy X-ray absorptiometry (DXA). DXA is a simple and painless test. The test will require your child to lay on an X-ray bed. The total scan takes about 20 minutes and is very low dose radiation. The DXA scan will be done by an experienced certified medical X-ray technologist and will take place at the Human Nutrition Research Unit (HNRU). If your child is female, she will be asked to complete a pregnancy test. Pregnant females cannot participate in a DXA scan because of the possible risks connected with radiation exposure to the developing baby.

Abdominal Scan: Your child's abdomen will be scanned using magnetic resonance imaging (MRI). This test is done to measure the amount and location of fat in your child's belly. The test is painless and safe. The measurement is done by a medical technologist in the In Vivo NMR Centre, University of Alberta Hospital.

Intervention:

After the pre-intervention visits (baseline visits 1-4) are completed, your child will be randomly assigned to 1 of the following 3 weight management programs:

1. Healthy Initiatives Program for Youth (HIP for Youth)
    - 16-session program delivered over a 16 – 20 week period; each session will be ~60 minutes long

   - A new program; may reduce the risk of type 2 diabetes in boys and girls, but is currently untested
   - Goals include increased physical activity, decreased inactive time and increased vegetable and fruit intake
   - A registered dietitian, exercise specialist or registered nurse will deliver this program to your son/daughter
   - Location – PCWH (Stollery Children's Hospital)

2. Youth Lifestyle Program (YLP)
   - 16-session program delivered over a 16 – 20 week period; each session will be 30 – 45 minutes long
   - An established program; has reduced the risk of type 2 diabetes in adults, but has not yet been tested in boys and girls
   - Goals include weight loss and increased physical activity
   - A registered dietitian, exercise specialist or registered nurse will deliver this program to your son/daughter
   - Location – PCWH (Stollery Children's Hospital)

3. Current Care*
   - 1 assessment visit with the PCWH nurse or pediatrician, psychiatrist, dietitian and exercise specialist
   - 1 counselling visit with a PCWH dietitian and exercise specialist
   - Location – PCWH (Stollery Children's Hospital)

*Note: If your child has been assigned to the Current Care group, he/she will also be placed on a waiting list. At the end of the intervention period, your child will receive either the HIP for Youth or YLP. Right now, we do not know if one of these programs is better than the other. However, by the end of your child's study participation, we may know and this will help to decide which program is best for him/her. Therefore, everyone who participates in this study will (eventually) take part in a 16-session weight management program.

At the end of the intervention period, your child will return for post-intervention testing.

Post-Intervention Visit 1 (~3-4 hours):

Similar to the testing done before the intervention, your child will complete a brief physical exam and an interview with the study psychiatrist. Your child's blood pressure will also be assessed at this visit. You and your child will be asked to complete the same questionnaires completed at the baseline visits and you will each have anthropometric measures done (for example, height, weight, hip and waist circumference). Diet records and pedometers will be provided to your child at this visit.

Post-Intervention Visit 2 (~1.5 hours):

Participants will return the completed physical activity and food records at this visit. He/she will complete the physical activity questionnaires and the fitness tests (grip test and Balke Treadmill test).

Post-Intervention Visit 3 (~2.5 hours):

Your child will complete the fasting blood sample and oral glucose tolerance test (OGTT) at this visit. You and your child will be accompanied by the project coordinator (Julie Lenk) to the OGTT.

Post-Intervention Visit 4 (~2.5 hours):

Accompanied by the project coordinator, your child will undergo the abdominal scan (MRI) and the DEXA scan on this visit.

Possible Benefits

At the present time, there is little information about the types of programs that can help overweight adolescents change lifestyle behaviours and improve their health. The results from this study will determine the type(s) of weight management programs that could help overweight adolescents become healthier. Also, the adolescents that will take part in this study have an increased risk of type 2 diabetes, so it is very likely that they will benefit from this study.

Possible Risks

The risks connected with participating in this study are minimal and are mostly related to the testing procedures. Blood samples from the OGTT may cause some pain due to the needle prick and could cause some mild bruising. A registered nurse that has experience working with children will be doing all blood samples. Risks of the X-ray dose for the DXA scan are very low and safe. With the exception of pregnancy, there are no known risks connected with a DXA scan. The potential risks connected with radiation exposure to an unborn fetus are not known, and therefore if your daughter will be participating in this study she will be asked to take a pregnancy test to ensure she is not pregnant. Results of the pregnancy test will be kept strictly confidential.

The MRI scan may make your child feel anxious because the machine makes loud and unusual noises when it scans. When your child's belly is scanned, he/she will be positioned in a machine that is shaped like a giant tube. The space in the middle of the tube is fairly small, so your child may feel anxious during the scan. Verbal encouragement and direction will be provided during the test to minimize risk of nervousness and anxiety.

Possible side effects associated with the fitness test includes muscle discomfort/soreness, shortness of breath, and an abnormal heartbeat and blood pressure. However, all side effects are rare in healthy young individuals. To maximize safety and minimize risks for your child, two health professionals will be present throughout all tests. Heart rate and blood pressure will be monitored as part of the testing procedure to help health professionals decided if a test should be stopped early, or if additional 'cool down' time is required. A pediatrician will perform a physical exam and medical history with all boys and girls before the fitness test, so possible problems for testing will be assessed in advance. The research staff will explain all of these tests to you and your family. The staff will also answer any questions and address any concerns you may have.

Some of the tests are performed at the University of Alberta. Therefore, your child may be walking from the PCWH or the Stollery Children's Hospital to various buildings at the University of Alberta. During off sight travel, your child will be accompanied by a staff of the PCWH or the project coordinator and safety precautions will be followed.

Confidentiality

All information collected from your child will be recorded on paper and entered into a computer. All the information recorded and typed will be private and your child's name will not appear in any report. Only members of the research staff will have access to the information. A copy of the data with all names removed will be stored at the PCWH. The results of this study may be published in a scientific journal or presented at a scientific conference. However, participant names will be kept strictly confidential and only group data (no individuals will be identified) will be reported.

Freedom to Withdraw

Your participation in this study is completely voluntary. If you decide at any time that you do not want to include your child in this study, it will not change your child's medical care in any way, now or in the future. You may remove your child from the study at any time. Children will also be asked if they are willing to participate, and their wishes will be respected. Children are also free to withdraw from this study at any time with no questions asked.

Other Options

If your family decides not to participate in this study, there are other options to help your child manage his or her weight. For example, you can book an appointment with a private registered dietitian or a personal fitness trainer or sign up for an exercise program at a fitness centre like the YMCA.

Additional Contacts

If you have any concerns about any aspect of this research study, you may contact the Patient Concerns Office of the Capital Health Region at 407-1040. This office has no connection with the study researchers.

Adolescent Information Sheet & Assent

Title Of The Study: The HIP (Healthy Initiatives Program) Study

Dr. Geoff DC Ball, PhD, RD	Julie Lenk, RD, MSc Candidate
Principle Investigator, Phone: 780-407-3784	Project Coordinator, Phone: 780-492-8837

It is important that you read (or have read to you) all of the information in this form. This information will help you to decide whether or not you want to participate in this study. Please ask if there are any words or information that you do not understand. If you have questions, please ask them at any time.

Purpose Of This Study

The purpose of this study is to compare 3 different weight management programs for overweight teens (13-17 years old) that have a family history of type 2 diabetes.

What Happens If You Take Part In The Study?

Once your parent or guardian has signed the consent form and you have agreed to participate in the study, you will be asked to attend several visits at the Stollery Children's Hospital. Visits will take place before and after starting the weight management program.

What Happens At The Visits?

The visits will take place at the Stollery Children's Hospital and the University of Alberta. Each visit will take about 1.5 to 3 hours and will include a number of different interviews, tests and questionnaires.

You will be asked to meet with the study doctor or nurse for a physical exam and the study psychiatrist to make sure the study is right for you. Other tests that you will be asked to take part in are a blood pressure test, a blood sugar test to determine if you have type 2 diabetes, a DXA body scan which measures the amount of bone, muscle and fat in your body, a BIA test which measures the amount of fat and fat-free mass in your body, fitness / activity test, and a belly scan using magnetic resonance imaging (MRI). Your height, weight, hip and waist measurements will be taken and you will be asked to complete a few questionnaires on self-esteem, your physical activity level and your meal pattern. You will also be asked to record your food intake and the number of steps you take over 4 days. You will be given a pedometer (a small device that is attached at the waist) to measure the number of steps you take each day. Each of the tests and questionnaires listed above will be done before **and** after you complete the weight management program.

Weight Management Programs:
At the second visit, you will be randomly assigned to 1 of the following 3 programs:

4. Healthy Initiatives Program for Youth (HIP for Youth)
    - 16-session program delivered over a 16 – 20 week period; each session will be ~60 minutes long
    - A new program; may reduce the risk of type 2 diabetes in boys and girls, but is currently untested.
    - Goals include increased physical activity, decreased inactive time and increased vegetable and fruit intake
    - A registered dietitian, exercise specialist or nurse will deliver this program
    - Location – Pediatric Centre for Weight and Health (PCWH) (Stollery Children's Hospital)

5. Youth Lifestyle Program (YLP)
    - 16-session program delivered over a 16 – 20 week period; each session will be 30 – 45 minutes long
    - An established program; has reduced the risk of type 2 diabetes in adults, but has not yet been provided to children or adolescents
    - Goals include weight loss and increased physical activity
    - A registered dietitian, exercise specialist or nurse will deliver this program
    - Location – PCWH (Stollery Children's Hospital)

6. Current Care*
    - 1 assessment visit with the PCWH nurse or pediatrician, psychiatrist, dietitian and exercise specialist
    - 1 counselling visit with a PCWH dietitian and exercise specialist
    - Location – PCWH (Stollery Children's Hospital)

*Note: If you have been assigned to the Current Care group, you will spend an hour with both the dietitian and the exercise specialist. After 4 months, you will receive either the HIP for Youth or YLP. Right now, we do not know if one of these programs is better than the other. However, by the end of your study participation, we may know and this will help to decide which program is best for you. Therefore, everyone who participates in this study will (eventually) take part in a 16-session weight management program.

Possible Benefits

Right now, we do not know very much about what programs help overweight teens to lose weight and become healthier. This study will help us to learn more about what works and what does not work. All of the teens who take part in this study have an increased risk of type 2 diabetes. So, it is likely that most boys and girls will benefit from this study (for example, increase physical activity, improve diet, and decrease body fat).

Possible Risks

The risks of this study are minimal and mostly relate to the testing procedures. Taking blood samples may cause some pain due to the needle prick and could cause some mild bruising. A registered nurse that has experience working with children will be doing all blood samples. Risks of the DXA body scan are very low. With the exception of pregnancy, there are no known risks connected with a DXA scan. The potential risks of radiation exposure to an unborn baby are not known. Before this test, all girls will be asked to take a pregnancy test to make sure they are not pregnant. The results of the pregnancy test will be kept strictly confidential. The MRI belly scan may make you feel nervous because the machine makes strange noises. When your belly is scanned, you will be positioned in a machine that is shaped like a giant tube. The space in the machine (middle of the tube) is fairly small, so you may feel a bit nervous during the scan. The fitness test may cause some muscle discomfort/soreness, shortness of breath, and an abnormal heartbeat and blood pressure but these side effects are rare. Two health professionals will be with you at all times during your fitness test to make sure you are feeling in good health. The research staff will explain everything to you and your family. We will also answer any questions you may have.

Some of the tests are performed at the University of Alberta. Therefore, you may be walking from the PCWH or the Stollery Children's Hospital to various buildings at the University of Alberta. During off sight travel, you will be accompanied by a staff of the PCWH or the project coordinator and safety precautions will be followed.

Confidentiality

All information collected from you will be recorded on paper and entered into a computer. All the information recorded and typed will be private and your name will not appear in any report. Only members of the research staff will have access to this information. A copy of the data with all names removed will be stored at the Pediatric Centre for Weight and Health. The results of this study may be published in a scientific journal or presented at a scientific conference. However, only group information (no individuals will be identified) will be reported.

Freedom to Withdraw

Your participation in this study is completely voluntary. If you decide at any time that you or your parent/guardian do not want you to be in this study, that is OK. You can stop being in the study at any time.

Additional Contacts

If you have any concerns about any aspect of this research study, you may contact the Patient Concerns Office of the Capital Health Region at 407-1040. This office has no connection with the study researchers.

ASSENT FORM

This research study has been explained to me and I agree to be in this study:

- I have been allowed to ask questions about the study.
- All of my questions have been answered to my satisfaction.
- I will be given a signed copy of this form to keep for myself.
- I agree to take a pregnancy test (for girls).
- If I change my mind after starting the study and want to stop participating, I will tell the study coordinator right away.
- No one will be upset with me if I do not want to be in this study.
- I agree to be in this study.

____
Printed Name of Teen

____ ________________
Signature of Teen Date

____

I confirm that I have explained the study to the subject to the extent compatible with the participant's understanding, and that the participant has agreed to be in the study.

____
Printed Name of Person Explaining the Assent

____ ________________
Signature of Person Conducting the Assent Discussion Date

CONSENT FORM

Title of Project: The HIP (Healthy Initiatives Program) Study

Principal Investigator: Dr. Geoff DC Ball, PhD, RD Phone: (780) 407-3784	**Co-Investigator:** Julie Lenk, RD, MSc Candidate Phone: (780) 492-8837

Please circle your answers:

Do you understand that you have been asked to include your son or daughter in a research study?		Yes	No
Have you received and read a copy of the attached Information Sheet?		Yes	No
Do you understand the benefits and risks involved in including your son or daughter in this research study?		Yes	No
Have you had an opportunity to ask questions and discuss this study?		Yes	No
Do you understand that your son or daughter is free to refuse to participate or withdraw from the study at any time? Neither you nor your child has to give a reason. Refusing to participate or withdrawing will not affect the medical care your family receives.		Yes	No
Has the issue of confidentiality been explained to you? Do you understand who will have access to your child's information?		Yes	No
Do you agree to allow your daughter to undergo a pregnancy test? (Required for DXA scan)	N/A	Yes	No
Do you want the investigator(s) to inform your family doctor that your child is participating in this research study?		Yes	No

If 'Yes', please provide your child's doctor's name and contact information:

____

Child's Name: ______________________________

This study was explained to me by: ______________________

I agree to allow my son or daughter to take part in this research study.

Signature of Parent or Guardian	Date	Signature of Witness
Printed Name of Parent or Guardian	Date	Printed Name of Witness

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to allow their child to participate.

Signature of Investigator or Designee	Date

CONSENT FORM – Parent/Guardian Health Measures

Title Of The Study: The HIP (Healthy Initiatives Program) Study

Principal Investigator: **Dr. Geoff DC Ball, PhD, RD**	**Project Coordinator:** **Julie Lenk, RD, MSc Candidate**
Phone: 780-407-3784	Phone: 780-492-8837

We want to measure family factors that may play an important role in your child's success in weight management. Some of these factors include ethnic background and parental body shape and weight. Therefore, we will be asking you questions about your family's background origin. We will also measure your waist and hip circumferences, height and weight. By signing this consent form, you agree to allow us to take these measurements.

Signature of 1st Parent or Guardian	Date	Signature of Witness
Printed Name of 1st Parent or Guardian	Date	Printed Name of Witness
Signature of 2nd Parent or Guardian (if available/applicable)	Date	Signature of Witness
Printed Name of 2nd Parent or Guardian (if available/applicable)	Date	Printed Name of Witness
Signature of Investigator or Designee	Date	Printed Name of Investigator/ Designee

Information Sheet

Title of the Project: **Weight management for overweight 13-17 year old boys and girls**

Principal Investigator:	**Co-Investigators:**	
Dr. Geoff DC Ball, PhD, RD Assistant Professor, Department of Pediatrics and Child Health Phone: (780) 407-3784	Dr. Linda Casey, MD Dr. Rachel Keaschuk, Psy. D. Dr. Linda McCargar PhD RD	Kelly MacKenzie MSc Bobbi Barbarich, MSc RD Dena Gushattey, RN, MS student

If anything you read is not clear to you, please ask to have it explained. You may ask questions at any time.

Purpose of the Study

The purpose of this research study is to compare different programs for improving the health and lifestyle behaviors in overweight boys and girls, 13 to 17 years of age. The results will help to develop weight management programs for the Pediatric Centre for Weight and Health (PCWH).

Background

The rate of overweight among Canadian youth has increased over the past several years. Part of the reason for this increase is thought to be due to changes in nutrition and physical activity levels. Overweight boys and girls are at an increased risk of health problems, such as type 2 diabetes and heart disease. At the present time, we know very little about what types of programs help overweight children and adolescents improve their health. In this study, we will look at different programs that may help overweight boys and girls become healthier.

Procedures

Once we receive your consent form, your child will also be asked to agree to take part. Your child will be randomly assigned to one of the programs.

Pre-Intervention Visit – Day 1 (~1.5 - 3 hours long):
Measurements will be made at the PCWH and will include the following:

> **Physical Exam:** The PCWH pediatrician or nurse will carry out a medical history and physical exam. The pediatrician or nurse will also meet with you to get information on ethnicity, family history of type 2 diabetes and heart disease as well as socioeconomic status. Height and weight will also be measured in both you and your child.
>
> **Blood Pressure:** Your child's blood pressure will be measured using a programmed monitor. This will require your child to sit quietly. The total test will take about 15 minutes.

Psychiatrist/psychologist Interview: The PCWH child psychiatrist or psychologist will interview you to make sure the study is right for your child.

Physical Activity – Pedometer: Your child will use a pedometer to keep track of the number of steps he/she takes over 4 days. A pedometer is a small device that is attached at the waist and tracks the number of steps taken. Both you and your child will receive pedometers and will be shown by a member of our research staff how to use it. Booklets will be provided to write down the number of steps taken per day.

Food Record: The PCWH staff will teach you and your child how to complete food records. Your child will then be asked to record their food intake for 4 days. This will occur at the same time he/she is wearing the pedometer.

Questionnaires: You and your child will be asked to complete several questionnaires that include questions about school, work (if they work), lifestyle behaviours, social environment, physical activity, body image, peer and family relationships.

Pre-Intervention Visit – Day 2 (~1.5 - 3 hours long; ~7 – 10 days after Day 1):

Physical Activity – Pedometer and Food Record: Your child will return the pedometer log book and food record at this time.

Physical Activity Interview: Your child will talk with PCWH staff to see how active they were over the last 7 days.

Grip Strength Fitness Assessment: Your child will squeeze a hand grip to measure upper body strength in each arm. Two trials will be performed. The highest score will be recorded.

Aerobic Fitness Assessment: Aerobic fitness will be measured through a graded walking test on a treadmill. A modified Balke treadmill protocol will be followed for this test. Resting heart rate and blood pressure will be measured before the test. Your child will get used to the treadmill with a 5 minute warm-up. During the test, heart rate, blood pressure and effort will be monitored. Heart rate and blood pressure will also be monitored for up to 5 minutes after the test. The test will be performed in the Butterdome, University of Alberta.

Fasting Blood Sample (may be completed on a separate day): The fasting blood sample will be done by a person trained to take blood. The PCWH staff will provide you with a requisition. Your child will provide a fasting blood sample at the University of Alberta Hospital Outpatient Laboratory before the intervention starts for your family.

Intervention:

After the pre-intervention visits are done, your child will be assigned to 1 of 3 groups:

7. Healthy Initiatives Program for Youth (HIP for Youth)
    - 16-meeting program given over a 16 – 20 week period; each meeting will be ~60 minutes long
    - A new program; may lower the risk of cardiovascular disease and type 2 diabetes in boys and girls, but is not yet tested
    - Program goals include increasing physical activity, decreasing inactive time and increasing vegetable and fruit intake

- A PCWH health professional will deliver this program to your son/daughter
- Location - Pediatric Centre for Weight and Health (Stollery Children's Hospital)

8. Youth Lifestyle Program (YLP)
    - 16-meeting program given over a 16 – 20 week period; each meeting will be ~60 minutes long
    - A program already tested in adults and lowers risk of type 2 diabetes; the program has not been tested in teens
    - Program goals include weight loss and increasing physical activity
    - A PCWH health professional will deliver this program to your son/daughter
    - Location – Pediatric Centre for Weight and Health (Stollery Children's Hospital)

9. Current Care
    - An assessment and counseling visit with the Centre dietitian and exercise specialist. Boys and girls in this group are place on a waiting-list. Once the wait-list period is finished (~16 weeks), your child will enroll in either HIP or YLP program. In the end, everyone receives a program, but the "wait-list" group has to wait ~4 months before starting.

At the end of the program period, your child will return for post-intervention testing.

Post-Intervention Visit (~3.0 hours):

Similar to the testing done before the start of the program, your child will have a fasting blood sample and a brief check-up, as well as tests to measure fitness. Both you and your child will have anthropometric measures done (for example, height and weight). Diet records and pedometers will be given to your child at the final program session. He/she will bring back the finished records at this visit. Questionnaires and a brief interview with the PCWH child psychiatrist will also take place at this visit.

Possible Benefits

At the present time, there is little information about the types of programs that can help overweight adolescents improve their lifestyle behaviors and their health. The results from this study will determine the type(s) of weight management programs that could help overweight adolescents become healthier.

Possible Risks

We believe the risks related to being part of this study are minor and are mostly related to the tests. The PCWH staff will explain all of these tests to you and your family. They will also answer any questions or concerns you may have.

Confidentiality

All information we get from you and your child will be recorded on paper and then put into a computer. This information will be private. Your child's name will not appear on any report. Only members of the PCWH research staff will see the information in your child's PCWH medical chart. The results of this study may be printed in a scientific journal or presented at a scientific conference. However, names will be kept strictly confidential and only group data will be reported. Your child's / family's information may be shared with your family doctor (or the doctor who referred you to the PCWH, if different) ONLY after you agree in writing to do so.

Freedom to Withdraw

You will be a volunteer in this study. If, at any time, you or your child chooses not to take part in this study, it will not change the care your child will get. You may remove your child from the study at any time. Children will also be asked if they want to take part. At any time, children are free to stop being part of the study. We will not ask for reasons.

Other Options

If your family decides not to be part of this study, there are other choices to help your child manage his or her weight. For example, you can book an appointment with a private dietitian or a fitness trainer, or sign up for an exercise program at a fitness centre (for example, the YMCA).

Additional Contacts

If you have problems about any part of this research study, you may contact the Patient Concerns Office of the Capital Health Region at 407-1040. This office has no connection with this study or the researchers.

Adolescent Information Sheet & Assent Form

Title of the Project: **Weight management for overweight 13-17 year old boys and girls**

Principal Investigator	**Co-Investigators:**	
Dr. Geoff DC Ball, PhD, RD	Dr. Linda Casey, MD	Kelly MacKenzie, MSc
Assistant Professor,	Dr. Rachel Keaschuk, Psy.D.	Bobbi Barbarich, MSc RD
Department of Pediatrics and Child Health	Dr. Linda McCargar PhD RD	Dena Gushattey, RN, MN student
Phone: 780-407-3784		

It is important that you read (or have read to you) all of the information in this form. This information will help you choose whether or not you want to be part of this study. If there are words or information you do not understand, please ask. You may ask questions at any time.

Purpose of this Study

The purpose of this study is to compare different programs for overweight teens (13-17 years old).

What Happens If You Take Part In The Study?

Once your parent or guardian has signed the consent form and you agree to be part of the study, you will be asked to come to 2 measurement visits. After these visits, you will take part in a 4 month program. The program is set up by health professionals. These people can help you and your family make healthier food choices and become more physically active. After the 4 month program, you will return for 1 final measurement period.

What Happens At The Visits?

The visits will take place at the Stollery Children's Hospital. Each visit will take about 1.5 – 3.0 hours and will include some interviews and questionnaires.

You will be asked to meet with a nurse or doctor, for a check-up. A second doctor (psychiatrist or psychologist) will talk with you to make sure the study is right for you. You will have your blood pressure tested and have a small blood sample taken. You will be asked to do a BIA test (which measures the amount of fat and fat-free mass in your body). Your height and weight will be measured. You and will complete some questionnaires on how you feel about yourself and about your physical activity. Your parents will fill out some questionnaires as well. A fitness test will take place on some of the visits.

For 4 days, you will also be asked to record what you eat and the number of steps you take. We will give you a pedometer, a small unit to wear around your waist, to measure your steps. Each of the tests and questionnaires listed above will be done before and after you complete the 4 month program.

Weight Management Programs:

After the first 2 visits are finished, you will be put into 1 of 3 groups:

1. Healthy Initiatives Program for Youth (HIP for Youth)
    1. 16-meetings that take place over a 16 – 20 week period; each session will be 45 – 60 minutes long
    2. A new program, not yet tested.
    3. At the meetings, we will work toward more physical activity, less inactive time and more vegetable and fruit intake
    4. The PCWH dietitian, nurse, psychologist or exercise specialist will lead the meetings
    5. Location – Pediatric Centre for Weight and Health (Stollery Children's Hospital)

2. Youth Lifestyle Program (YLP)
    1. 16-meetings that taking place over a 16 – 20 week period; each meeting will be 30 – 60 minutes long
    2. A program already used for adults, but not yet tested in teens
    3. At the meetings, we will work toward some weight loss and more physical activity
    4. The PCWH dietitian, nurse, psychologist or exercise specialist will lead the meetings
    5. Location – Pediatric Centre for Weight and Health (Stollery Children's Hospital)

3. Current Care
   An assessment and counseling visit with the PCWH dietitian and exercise specialist. After about 4 months, you will enroll in either the HIP or YLP program.

Possible Benefits

Right now, we do not know very much about what programs help overweight teens to lose weight and become healthier. This study will help us to learn more about what works and what does not work. It is likely that most boys and girls will benefit from this study (for example, increase physical activity, improve diet, and decrease body fat).

Possible Risks

The risks of this study are small and mostly relate to the tests. Taking blood samples may cause some pain due to the needle prick and could cause some mild bruising. People trained to take blood samples will do this. Part of the intervention may include off-site travel (walking from the hospital to the Butterdome) for fitness testing. The fitness testing may result in aching muscles or shortness of breath. During the 4 month program, you will have the chance to talk about your feelings and emotions. Sometimes, it is hard to talk about how you feel. However, we will do our best to make sure you are comfortable. You don't have to share things if you don't want to. The PCWH research staff will explain everything to you and your family. We will also answer any questions you may have.

Confidentiality

All information we get from you during the study will be recorded on paper and then put into a computer. All the information we get from you will be private and your name will not be seen in any report. Only members of the PCWH research staff will see this information. The results of this study may be printed in a scientific journal or presented at a scientific conference. However, only group information will be reported. You, as an individual, will not be identified. Your family's information may be shared with your family doctor (or the doctor who referred you to the PCWH, if different) ONLY after you agree in writing to do so.

Freedom to Withdraw

You are a helper in this study. If you decide at any time that you or your parent/guardian do not want you to be in this study, that is OK. You can stop being in the study at any time.

Additional Contacts

If you have any problems about any part of this study, you can phone the Patient Concerns Office (407-1040). This office has no connection with this research or the PCWH staff.

Assent Form

Please circle your answers:

This research study has been explained to me and I agree to be in this study:	YES	NO
▪ I have been allowed to ask questions about the study.	YES	NO
▪ All of my questions have been answered.	YES	NO
▪ I will get to keep a signed copy of this form to keep for myself.	YES	NO
▪ I will tell the PCWH staff right away if I want to stop the study.	YES	NO
▪ No one will be upset with me if I do not want to be in this study.		
▪ I agree to be in this study.	YES	NO

____
Printed Name of Teen

____ ________________
Signature of Teen Date

____

I confirm that I have explained the study to the subject to the extent compatible with the participant's understanding, and that the participant has agreed to be in the study.

____
Printed Name of Person explaining the Assent

______________________________________ ________________
Signature of Person conducting the Assent discussion Date

CONSENT FORM

Title of Project: Weight management for overweight 13-17 year old boys and girls

Principal Investigator:	**Co-Investigators:**	
Dr. Geoff DC Ball, PhD, RD	Dr. Linda Casey, MD	Kelly Mackenzie MSc
Phone: (780) 407-3784	Dr. Rachel Keaschuk, Psy.D.	Linda McCargar PhD RD
	Bobbi Barbarich, MSc RD	Dena Gushattey, RN. MS student

Please circle your answers:

Do you understand that you have been asked to allow your son or daughter to take part in a research study?		Yes	No
Have you read the Information Sheet?		Yes	No
Do you understand the benefits and risks of allowing your son or daughter to take part in this research study?		Yes	No
Have you had a chance to ask questions and talk about this study?		Yes	No
Do you understand that your son or daughter can choose to not take part in, or withdraw at any time from the study?		Yes	No
Has the issue of confidentiality been explained to you? Do you understand who will have access to your child's information?		Yes	No
Do you agree to allow your daughter to undergo a pregnancy test?	N/A	Yes	No
Do you want the investigator(s) to inform your family doctor that your child is participating in this research study?		Yes	No

If 'Yes', please provide your child's doctor's name and contact information:

____

Child's Name: ______________________________

This study was explained to me by: ______________________

I agree to allow my son or daughter to take part in this research study.

______________________ ____________ ______________________

Signature of Parent or Guardian   Date   Signature of Witness

______________________ ____________ ______________________

Printed Name of Parent or Guardian   Date   Printed Name of Witness

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to allow their child to participate.

______________________ ____________

Signature of Investigator or Designee   Date

CONSENT FORM – Parent/Guardian Health Measures

Title of Project: Weight management for overweight 13-17 year old boys and girls

Principal Investigator:	**Co-Investigators:**	
Dr. Geoff DC Ball, PhD, RD	Dr. Linda Casey, MD	Kelly Mackenzie MSc
Phone: (780) 407-3784	Dr. Rachel Keaschuk, Psy.D.	Dr. Linda McCargar, PhD, RD
	Bobbi Barbarich, MSc, RD	Dena Gushattey, RN, MD student

To help us determine the success of your child's program, we want to measure family factors that may play an important role. Some of these factors include ethnic background and body shape of parents. This information is also important because it may play a role in your child's health status. We will ask you questions about your family's origin and also take several measurements including height, weight and waist and hip circumferences. By signing this consent form, you agree to allow us to take these measurements.

______________________	__________	______________________
Signature of Parent or Guardian	Date	Signature of Witness
______________________	__________	______________________
Printed Name of Parent or Guardian	Date	Printed Name of Witness

____
Name of child involved in study (please print)

______________________	__________	______________________
Signature of Investigator or Designee	Date	Printed name of Investigator/ Designee

Appendix B: Parent and Family Questionnaire

PARENT AND FAMILY QUESTIONNAIRE

This questionnaire asks questions about your neighbourhood, your child and you. Please complete it as honestly as you can.
If you have any questions, please ask one of the health professionals at the Pediatric Centre for Weight and Health.

Completed by: ____________ Relationship to child: ______________

Date: _____________
(DD/MM/YYYY)

QUESTIONS ABOUT WHERE YOU LIVE

1. How long have you lived at your current address?

_____ Less than one year
_____ 1-3 years
_____ 4-5 years
_____ 6-10 years
_____ More than 10 years

2. For the following statements about your neighbourhood, please circle the number corresponding to how much you agree.

1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree

a. I like living where I live.	a.	1	2	3	4	5
b. It is safe for children to play outside during the day.	b.	1	2	3	4	5
c. There are good parks, playgrounds, and/or play spaces in this neighbourhood.	c.	1	2	3	4	5
d. People in my neighbourhood are willing to help each other out.	d.	1	2	3	4	5
e. There are adults in this neighbourhood that children can look up to (respect).	e.	1	2	3	4	5
f. I generally trust my neighbours to look out for my property.	f.	1	2	3	4	5
g. My neighborhood is a safe place to bring up children.	g.	1	2	3	4	5

3. The following questions ask about problems that arise in neighbourhoods. Please answer to what extent these are a problem in your neighbourhood.

1 = a big problem; 2 = somewhat of a problem; 3 = no problem

a. Litter, broken glass or garbage in the street or road, on the sidewalk or in yards.	a. 1 2 3
b. Groups of young people who cause trouble.	b. 1 2 3
c. Selling drugs, or abusing drugs or alcohol.	c. 1 2 3

4. The following is a list of neighbourhood characteristics. Please rate *the quality* of the following items in your neighbourhood.

1 = excellent; 2 = very good; 3 = good; 4 = fair; 5 = poor

a. The condition of housing.	a. 1 2 3 4 5
b. Shops and services.	b. 1 2 3 4 5
c. Health services.	c. 1 2 3 4 5
d. Recreation programs and services.	d. 1 2 3 4 5

5. Please indicate how your child usually travels **to school**.

______ School bus
______ City bus
______ Walks/bikes
______ Is driven/drives
______ Other

6. Please indicate how your child usually travels home **from school**.

______ School bus
______ City bus
______ Walks/bikes
______ Is driven/drives
______ Other

7. Please indicate how long it usually takes your child...

1 = 15 minutes or less; 2 = 15-30 minutes; 3 = 31-45 minutes; 4=more than 45 minutes

a. to get to school?	a. 1 2 3 4
b. to get home from school?	b. 1 2 3 4

8. Think about the past year (12 months). Please indicate how often your child usually does the following activities OUTSIDE OF SCHOOL HOURS.

1 = never or rarely; 2 = about once a month; 3 = about once a week; 4 = a few/most days/week

a. Play sports or do physical activity WITHOUT a coach or instructor (riding bike, skateboarding, rollerblading, etc)	a. 1 2 3 4
b. Play sports WITH a coach or instructor, other than in gym class (soccer, swimming lessons, hockey, gymnastics, etc)	b. 1 2 3 4
c. Take part in art, drama or music groups, or lessons outside of school hours (in the community)	c. 1 2 3 4
d. Activities such as music, arts and crafts, board games, or card collecting at home	d. 1 2 3 4
e. Take part in clubs or groups, such as Guides or Scouts, 4H club, community, church or other religious groups	e. 1 2 3 4
f. Read for fun	f. 1 2 3 4
g. Use a computer or play video games	g. 1 2 3 4
h. Watch TV	h. 1 2 3 4
i. Talking on the phone/text messaging	i. 1 2 3 4

9. On average, about how many hours per day does your child spend...

1 = less than 1 hr/day; 2 = 1-2hrs/day; 3 = 3-4 hrs/day; 4 = 5-6 hrs/day; 5 = 7 or more hr/day

a. Using a computer or playing video games?
b. Watching TV?
c. Talking on the phone/text messaging?

a. 1 2 3 4 5

b. 1 2 3 4 5

c. 1 2 3 4

QUESTIONS ABOUT YOUR CHILD

10. What was your child's birth weight? ____________________

11. How would you best describe the ethnic background of your child?

______ Aboriginal (______ North American Indian, ______ Métis, ______ Inuit, ______ Other)
______ White
______ Chinese
______ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
______ Black
______ Filipino
______ Latin American
______ Southeast Asian (Cambodian, Indonesian, Laotian, Vietnamese, etc.)
______ Arab
______ West Asian (e.g., Afghan, Iranian, etc.)
______ Japanese
______ Korean
______ Other, please specify__________________________

12. Where was your child born?

______ Canada
______ Other country (please specify)_________________________

13. Do you think being overweight is a health problem?

______ Yes
______ No
______ Not sure

14. What do you think of your child's current weight?

______ Very underweight
______ A little underweight
______ Average
______ A little overweight
______ Very overweight

15. Do you think your child's weight is a health problem?

______ Yes
______ No
______ Not sure

If you answered "no", skip the next section and go to question # 24.

The following questions review what you may have already done to help your child with his or her weight.

16. Have you changed the amount of juice that he or she drinks?

_____ Yes
_____ No

If you answered 'yes:'

How many cups per day did he or she drink *in the past*?______
How many cups does he or she drink *now*?_______
How often within the last month did you enforce this change?

_____All the time
_____Most of the time
_____Half of the time
_____Some of the time
_____Rarely

17. Have you changed on the amount of snacks or candy that he or she eats?

_____Yes
_____ No

If you answered 'yes:'

How often within the last month did you enforce this change?

_____All the time
_____Most of the time
_____Half of the time
_____Some of the time
_____Rarely

18. Have you changed the type of milk?

_____Yes
_____ No

If you answered 'yes:'

What did you switch to? _____2%, _____1%, or _____skim milk

How often within the last month did you enforce this change?

______All the time
______Most of the time
______Half of the time
______Some of the time
______Rarely

19. Have you changed the amount of fruits and vegetables you provide for your child per day?
______Yes
______ No

If you answered 'yes:'

How many servings per day did he or she eat *in the past*?__________

How many servings per day does he or she eat *now*?___________

How often within the last month did you enforce this change?

______All the time
______Most of the time
______Half of the time
______Some of the time
______Rarely

20. Is your child exercise more physically active (walk, run, ride a bike) now than before?
______Yes, he or she is more active
______No, he or she is less active
______No, he or she has not changed his or her activity level

If you answered 'yes:'
How many hours / day or week did he or she exercise?________

How many hours / day or week does he or she exercise now?______

How often within the last month did you enforce this change?

______All the time
______Most of the time
______Half of the time
______Some of the time
______Rarely

21. Have you changed the amount of screen time (TV, computer or video games) your child watches?
______Yes, he or she watches less
______No, he or she watches more
______No, he or she watches the same amount

If you answered 'yes:'

How much screen time did your child watch (hours/day)?__________

How much screen time does your child watch now?___________

How often within the last month did you enforce this change?

______All the time
______Most of the time
______Half of the time
______Some of the time
______Rarely

22. Have you done anything else to help your child lose weight?
______Yes
______ No

If you answered 'yes:'
Please describe what you have done.________________________
____
____
____
____

How often within the last month did you enforce this change?

______All the time
______Most of the time
______Half of the time
______Some of the time
______Rarely

23. Was it hard to make these changes?

______Yes
______ No
______Not sure

If you answered 'yes:'

Why was it hard to make these changes? ____________________
____
____
____
____

24. Previous to this clinic, had your child ever been referred to a weight management clinic (or health professional) to help manage his/her weight?

______Yes
______No
______Not sure

If you answered "no", skip the next two questions and go to question #27.

25. Did you ever go to this clinic or see this health professional?

______Yes
______No
______Not sure

26. Do you still go to this clinic or see this health professional?

______Yes
______No
______Not sure

QUESTIONS ABOUT YOU

27. In general, how do you describe your health?

______Excellent
______Very good
______Good
______Fair
______Poor

28. In general, how do you describe your eating habits?

______Very healthy
______Healthy
______Somewhat healthy
______Unhealthy
______Very unhealthy

29. In general, how do you describe your physical activity level?

______Very high
______High
______Moderate
______Low
______Very low

30. How do you describe your weight?

______Very underweight
______A little underweight
______Average
______A little overweight
______Very overweight

31. Are you thinking about making dietary changes (for example: eating less fat, eating more fruits and vegetables, eating less 'junk' food, etc) to help *your child* lose weight?

______Yes
______No
______Not sure

If you answered "no", please skip the next two questions and go to question #34.

32. How ready are you to make dietary changes? (please circle a number on the scale)

Not ready to change **Ready to change**

1 2 3 4 5 6 7 8 9 10

33. How likely are you to try to make dietary changes in the next 6 months?

_____Not likely
_____Somewhat likely
_____Very likely

34. Are you thinking about making physical activity changes (for example: walking more, playing active sports or games, etc) to help *your child* lose weight?

______Yes
______No
______Not sure

If you answered "no", please skip the next two questions and go to question #37.

35. How ready are you to make physical activity changes? (please circle a number on the scale)

Not ready to change **Ready to change**

1 2 3 4 5 6 7 8 9 10

36. How likely are you to try to make physical activity changes in the next 6 months?

_____Not likely
_____Somewhat likely
_____Very likely

37. Are you thinking about making sedentary activity changes (for example: watching less TV, playing video or computer games less often, etc) to help *your child* lose weight?

______Yes
______No
______Not sure

If you answered "no", please skip the next two questions and go to question #40.

38. How ready are you to make sedentary activity changes? (please circle a number on the scale)

Not ready to change							**Ready to change**		
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

39. How likely are you to try to make sedentary activity changes in the next 6 months?
____Not likely
____Somewhat likely
____Very likely

40. Has your doctor said to you that your child's weight is a health problem?
_____Yes
_____No
_____Not sure

If you answered "no", skip the next six questions and go to question # 47.

41. Did your child's doctor tell you *why* it is a health problem?

_____Yes
_____No
_____Not sure

42. Did you understand the explanation of why it is a health problem?
_____Yes
_____No
_____Not sure

43. How satisfied were you with your child's doctor's explanation?
____Not satisfied
____A little satisfied
____Neither satisfied or dissatisfied
____Satisfied
____Very satisfied

44. Did your child's doctor tell you what you can do to help your child with his or her weight?
______Yes
______No
______Not sure

45. Did you feel like you wanted to make these changes after you talked with your child's doctor?
______No suggestions were made.
______I did not want to make these changes.
______I thought about making these changes, but I did not feel like

doing anything.

______I wanted to make these changes.
______I was excited about making these changes.

46. Did you make any changes after you talked with your child's doctor?
______Yes
______No
______Not sure

47. What was the highest grade in school you finished?
______Elementary school (K to 6th grade)
______Junior high school (7th to 9th grade)
______Some high school (10th to 12th grade)
______High school graduate
______Some college or university
______College or university graduate
______Some trade school
______Trade school graduate

48. Do you receive government assistance (AISH, Social Assistance/Welfare, etc)?
______Yes
______No
______Not sure

49. Do you use the food bank?
______Yes
______No
______Not sure

If yes, how often?

______Once per week
______Once per month
______Twice per month
______Three times per month
______Not sure

50. If you answered 'no' to question # 48 and/or 49, are you *eligible* for government assistance or the food bank?

______Yes
______No
______Not sure

51. What is your current household income from all sources?

______Less than $10 000
______$10 001-20 000
______$20 001-30 000
______$30 001-40 000
______$40 001-50 000
______$50 001-60 000
______$60 001-70 000
______$70 001-80 000
______$80 001-90 000
______$90 001-100 000
______More than $100 000
______Don't know
______Prefer not to say

52. How would you best describe your ethnic background?

______ Aboriginal (______ North American Indian, ______ Metis, ______ Inuit, ______ Other)
______ White
______ Chinese
______ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
______ Black
______ Filipino
______ Latin American
______ Southeast Asian (Cambodian, Indonesian, Laotian, Vietnamese, etc.)
______ Arab
______ West Asian (e.g., Afghan, Iranian, etc.)
______ Japanese
______ Korean
______ Other, please specify________________________

53. Where were you born?

______Canada

______Other country (please specify)__________________

54. I am a ______male ______female

Thank you for filling out the questionnaire. If you have any questions, please ask one of the health professionals at the Pediatric Centre for Weight and Health.

APPENDIX C: 4-Day Food and Activity Record

Please follow the directions carefully...

1. Write your **name** and the **date** in the blanks.
2. Start on a Wednesday or a Sunday, so that you include one weekend day. Complete the records for 4 days in a row.
3. Remember to record **EVERYDAY!**

FOOD RECORD DIRECTIONS

Please include *everything you eat or drink*!!

This is very detailed...but we need detail to understand what, how much and when you eat.

1. Find the table for the **type of meal:** breakfast, lunch, dinner or snacks. If you don't eat that meal, skip that table. **Record the time**.
2. Write down **the time** when you begin your meal or snack.
3. Record **how much** (portion size/amount) you ate of each food or drink.
   - ★ If the food is from a package, look on the package to see how many grams or milliliters are in the package.
   - ★ Record how much (all, ¾, ½, ¼, etc) of the package you ate.
   - ★ Look at the label and include words such as light, low fat or diet.
   - ★ Use the serving size picture graph (attached) to estimate your portion size if is no label.
4. Write a **detailed description** of the food. Be as detailed as you can! Record condiments. Record what you drank. Write the brand name, if available.

5. **Circle** whether this was an **average day** for you.
6. If you took a **supplement** (vitamins or minerals, herbs, etc.) write what it was, the dose, and how many pills you took.

See the example on the following page.

EXAMPLE Day One Name: Marie Date: Monday May 15

7 am	1 Base ball	Raisin Bran
	1 Fist	Milk, 2%
	1 Fist	Orange juice, from concentrate
Who made it? Marie		
Where did you eat it? Dining room		
Who did you eat it with? Sister		
11:30 am	2 slices	Bread, 60% whole wheat, Safeway
	1 thumb tip	Becel margarine
	1 CD	Bologna, deli
	1 thumb tip	Mustard
	1	Fruit to go, raspberry
	3 erasers	Cheese, cheddar, regular, Cracker Barrel
	1 can, 355 mL	Sprite
Who made it? Mom		
Where did you eat it? School		
Who did you eat it with? Friends		

[illegible]		
5:30 pm	1 Computer mouse	Baked beans with maple syrup, Libby's
	1 Tennis ball	Rice, white
	1	Weiner, all beef, Schneider's
	1.5 tennis balls	Frozen peas
	2 thumb tips	Italian dressing, light
	1	Popsicle, green
Who made it? Mom		
Where did you eat it? Dining room		
Who did you eat it with? Family		
[illegible]		
10 am	6	Rice crackers, cheddar
4 pm	1	Fruit cup, Dole
	1 hockey puck	Chocolate chip cookie, homemade
8:30 pm	1 fist	Milk, 2%
	2	Chocolate chip cookies, homemade
Who made each snack? Mom, me, dad		
Where did you eat it/them? School, home		
Who did you eat it/them with? Friends, family		

WAS THIS AN AVERAGE DAY? [✓ SAME] / MORE / LESS

Did you take a supplement today? Circle: [✓ Yes] No

If yes, what was it? Write the dose and number of pills: 1 Vitamin C, 250 mg; 2 Calcium, 500 mg

Day One Name: ______________ Date: ______________________

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made each snack?		
Where did you eat it/them?		
Who did you eat it/them with?		

WAS THIS AN AVERAGE DAY? SAME / MORE / LESS

Did you take a supplement today? Circle: Yes / No

If yes, what was it? Write the dose and number of pills:____________________________________

Day Two Name: ______________ Date: ______________________

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made each snack?		
Where did you eat it/them?		
Who did you eat it/them with?		

WAS THIS AN AVERAGE DAY? SAME / MORE / LESS

Did you take a supplement today? Circle: Yes / No

If yes, what was it? Write the dose and number of pills:______________________________

Day Three Name: ______________ **Date:** ______________________

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made it?		
Where did you eat it?		
Who did you eat it with?		

[illegible]		
Who made it?		
Where did you eat it?		
Who did you eat it with?		

[illegible]		
Who made each snack?		
Where did you eat it/them?		
Who did you eat it/them with?		

WAS THIS AN AVERAGE DAY? SAME / MORE / LESS

Did you take a supplement today? Circle: Yes / No

If yes, what was it? Write the dose and number of pills:______________________________

Day Four Name: ______________ Date: ______________________

Who made it?		
Where did you eat it?		
Who did you eat it with?		

Who made it?		
Where did you eat it?		
Who did you eat it with?		

[illegible]		
Who made it?		
Where did you eat it?		
Who did you eat it with?		

[illegible]		
Who made each snack?		
Where did you eat it/them?		
Who did you eat it/them with?		

WAS THIS AN AVERAGE DAY? SAME / MORE / LESS

Did you take a supplement today? Circle: Yes / No

If yes, what was it? Write the dose and number of pills:______________________________________

PEDOMETER DIRECTIONS

1. Write down the time you woke up at each morning.
2. Put your pedometer on when you first get up in the morning. Remember to place it on your waist so it is directly over your dominant hip. Be sure it is at zero steps (push the reset button).
3. When you are going to bed at night, take the pedometer off.
4. Check the number on the display.
5. Record the number of steps for that day. If you had to take it off for some of the day (ie. swimming) please make a note.
6. Write down the time when you go to bed.
7. Push the **reset** button on the pedometer so it is ready for tomorrow.
8. Circle whether this was an average day for you.
9. Note if you took the pedometer off during the day, and for how long.

EXAMPLE:

Wake up Time	Sleep Time	Number of STEPS
7:00	10:00	5693

DAY ONE **NAME:** JOHN **DATE:** MONDAY MAY 15

1. **Did you wear the pedometer today?** [✓ YES] / NO
2. **Did you calibrate the pedometer in the morning?** [✓ YES] / NO
3. **Was this an Average Day of Activity?** SAME / MORE / [✓ LESS]
4. **Did you take the pedometer off during the day?** [✓ YES] / NO

If yes, why and for how long? 30 min: had a shower

DAY ONE NAME: ______________ **DATE:** ______________

Wake up Time	Sleep Time	Number of STEPS

1. **Did you wear the pedometer today?** YES / NO
2. **Did you calibrate the pedometer in the morning?** YES / NO
3. **Was this an Average Day of Activity?** SAME / MORE / LESS
4. **Did you take the pedometer off during the day?** YES / NO
   If yes, why and for how long? ________________________________

DAY TWO NAME: ______________ **DATE:** ______________

Wake up Time	Sleep Time	Number of STEPS

1. **Did you wear the pedometer today?** YES / NO
2. **Did you calibrate the pedometer in the morning?** YES / NO
3. **Was this an Average Day of Activity?** SAME / MORE / LESS
4. **Did you take the pedometer off during the day?** YES / NO
   If yes, why and for how long? ________________________________

DAY THREE **NAME:** ________________ **DATE:** ________________

Wake up Time	Sleep Time	Number of STEPS

1. **Did you wear the pedometer today?** YES / NO
2. **Did you calibrate the pedometer in the morning?** YES / NO
3. **Was this an Average Day of Activity?** SAME / MORE / LESS
4. **Did you take the pedometer off during the day?** YES / NO
   If yes, why and for how long? ____

DAY FOUR NAME: ________________ **DATE:** ________________

Wake up Time	Sleep Time	Number of STEPS

1. **Did you wear the pedometer today?** YES / NO
2. **Did you calibrate the pedometer in the morning?** YES / NO
3. **Was this an Average Day of Activity?** SAME / MORE / LESS
4. **Did you take the pedometer off during the day?** YES / NO
   If yes, why and for how long? ____

Pedometers

✓ Pedometers are a great way to record your activity each day!

✓ Pedometers can also motivate you to be more active more often during the day!

Did you know ...

★ that one average city block is ~200 steps

★ that ~1300 steps = 1 kilometer

★ that if you take ***all*** the stairs, you would walk ~ 350 steps from the entrance of the Stollery Children's Hospital to the PCWH.

  ○ If you walked up & down the stairs ***every*** visit, over 16 weeks you would have traveled close to ***10 kilometers***!

★ that pedometers were invented by Leonardo DaVinci over 500 years ago.

★ that Thomas Jefferson, the 3rd president of the United States, introduced the pedometer to America in the late 1700's.

★ that in Japan, the pedometer is called a "manpo-kei". In Japan, a typical household owns 3 pedometers.

How to use *your* pedometer:

★ When you first wake up, open the pedometer & press the "reset" button. Ensure you close it properly.

★ Put your pedometer on as soon as you get up.

★ Place the pedometer on your belt or waist band – it should be directly above your hip bone & knee. Also, attach the security strap to your waistband or pocket so it doesn't fall off.

★ Do a test walk: Check your pedometer for # of steps. Walk & count 20 steps. Stop & look at your pedometer. If it is not 19 – 21 steps higher, re-position your pedometer & try again.

★ Take off your pedometer when you are bathing or swimming – it does not like the water!

★ When you go to bed, take off your pedometer, record your steps & place it by your toothbrush. This will help you to remember to put it on first thing in the morning!

★ After you have recorded your daily steps, you may press the "reset" button for the next morning.

APPENDIX D: Physical Activity and Sedentary Activity Recall

PCWH Physical Activity Assessment – Pre-Intervention

Physical Activity History

Date: ____________ Interviewer: ________________
DD/MM/YYYY

Child

Current organized sports / PA? ☐ Yes (if yes, answer below) ☐ No
List activities & timeframes

Previous organized sports / PA? ☐ Yes (if yes, answer below) ☐ No
List activities & timeframes

Reasons for initiating: Reasons for terminating:

Comments:

Caregiver #1______________ **Relationship to Child:** ____________

Current organized sports / PA? ☐ Yes (if yes, answer below) ☐ No
List activities & timeframes

Previous organized sports / PA? ☐ Yes (if yes, answer below) ☐ No
List activities & timeframes

Reasons for initiating: Reasons for terminating:

Comments:

Caregiver #2______________ **Relationship to Child:** ____________
☐ Not Applicable

Current organized sports / PA? ☐ Yes (if yes, answer below) ☐ No
List activities & timeframes

Previous organized sports / PA? ☐ Yes (if yes, answer below) ☐ No
List activities & timeframes

Reasons for initiating: Reasons for terminating:
Comments:

Physical Activity Questionnaires

Date: ____________
DD/MM/YYYY

Interviewer: ________________

7 Day Recall

1. Were you at school in the last 7 days? ☐ Yes ☐ No (if No, skip to #4)
2. How many days of the last 7 days did you go to school? ______ # days
   Note any PE days, holidays, sick days, ...:

Please refer to attached 7 day PAR

3. Compared to your physical activity over the past 3 months, was last week's physical activity more, less or about the same?
   ☐ More ☐ Less ☐ About the same

To be completed after the interview:

4. Were there any problems with the 7 Day PAR interview?
   ☐ Yes (please explain) ☐ No

5. Do you think this was a valid 7 Day PAR interview?
   ☐ Yes ☐ No
6. Please list any activities reported by the subject that you don't know how to classify:

Overall Comments:

Calculations:

Weight: ____.__ kg
Sleep: ____.__ hour x 1 MET = _______ kcal / kg
Light: ____.__ hour x 1.5 METs = _______ kcal / kg
Moderate: ____.__ hour x 4 METs = _______ kcal / kg
Hard: ____.__ hour x 6 METs = _______ kcal / kg
Very Hard: ____.__ hour x 10 METs = _______ kcal / kg

Total weekly expenditure = _______ kcal/kg/week = _______ kcal / week
Total daily expenditure (÷7) = _______ kcal/kg/day = _______ kcal / day

7 Day Physical Activity Recall

Date: ____________
DD/MM/YYYY

Interviewer: ____________________

	DAY	☐ WD ☐ WE	☐ WD ☐ WE	☐ WD ☐ WE	☐ WD ☐ WE	☐ WD ☐ WE	☐ WD ☐ WE	☐ WD ☐ WE	
	DATE (dd/mm/yy)								**Week Total**
	Sleep (hours)								
Morning	**Moderate**								
	Hard								
	Very Hard								
Afternoon	**Moderate**								
	Hard								
	Very Hard								
Evening	**Moderate**								
	Hard								
	Very Hard								
Total time / day	**Strength**								
	Flexibility								
	Computer Time								
	Video Game Time								
	T.V. Time								

WD = weekday **WE** = weekend day